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ROADS AND STREETS

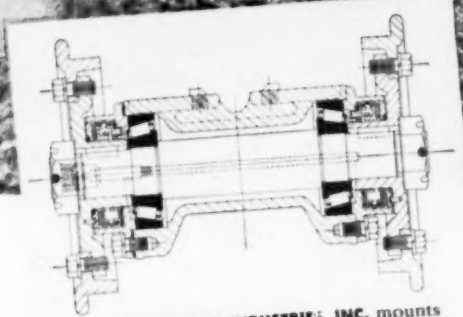
HIGHWAYS BRIDGES
AIRFIELDS
HEAVY CONSTRUCTION

NOVEMBER 1953

Gillette Publishing Co., 22 W. Maple St., Chicago, Ill.
Form 3547 Requested

Acceptance Authorized Under Sec. 34.64 P. L. & R.

Buried under dirt and sand, TIMKEN® bearings keep digger digging



How **GAR WOOD INDUSTRIES, INC.** mounts ditcher truck axles on Timken bearings. Note how flush-type lubrication system sends steady flow of oil through bearings.

HIDDEN under the pile of dirt indicated by the arrow in the picture is a 4-wheel truck that backs up the flying buckets of this Buckeye Model 314 Ditcher, made by Gar Wood Industries, Inc.

That dirt is one of the reasons the truck wheels are mounted on Timken® bearings. Because their tapered rollers permit preloading, they eliminate end-play in the axle. And their extreme accuracy keeps housing and shaft precisely concentric. As a result, the face-type oil seals can effectively seal out both dirt and the water encountered in digging ditches up to 6 feet deep. By the same token, oil is sealed in—so well, in fact, that these Timken bearings are normally lubricated only once every 1,000 hours.

These truck wheels, situated as they are directly behind the point where the buckets hit solid dirt, must also absorb the shocks of boulders and the digging action itself. But Timken bearings are ready for such shocks. Case-hardened rollers and races are both hard enough to resist wear and tough enough to take shocks and come back for more. And line contact between rollers and races gives Timken bearings all the extra capacity they need.

All told, 18 Timken bearings help prolong the life and reduce the maintenance of this Buckeye Ditcher. Normally, Timken bearings last the life of the machine itself. Specify them on the machines you build or buy. The Timken Roller Bearing Company, Canton 6, O. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN
TAPERED ROLLER BEARINGS

NOT JUST A BALL — NOT JUST A ROLLER — THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST — LOADS OR ANY COMBINATION

dynamic new engine
gives the popular D Motor Grader
increased work power

The thousands who own Allis-Chalmers Model D's know the ability of these versatile machines to do outstanding work on both construction and maintenance jobs. Now — with extra power and added features — the Model D sets even higher performance standards in the low-cost grader field.

Dynamic New Power-Crater Engine gives the Model D re-serve power to : (1) handle the same loads in higher gear or bigger loads in the same gear, (2) increase road speeds, especially where there are grades, (3) reduce need for shifting, thus lengthen clutch life, (4) give better all-round maneuverability. There's plenty of power to crowd while loading with the rear-end loader. Engine throttles down to half speed *and still does the same job* — on low-speed work.

Leaning front wheels* enable the Model D to handle new jobs . . . counteract side-draft on ditching and bank cutting.

Power circle turn* permits easy positioning of blade from operator's seat. When finishing subgrade or blacktop, for example, moldboard can be readily rotated without disturbing road surface.

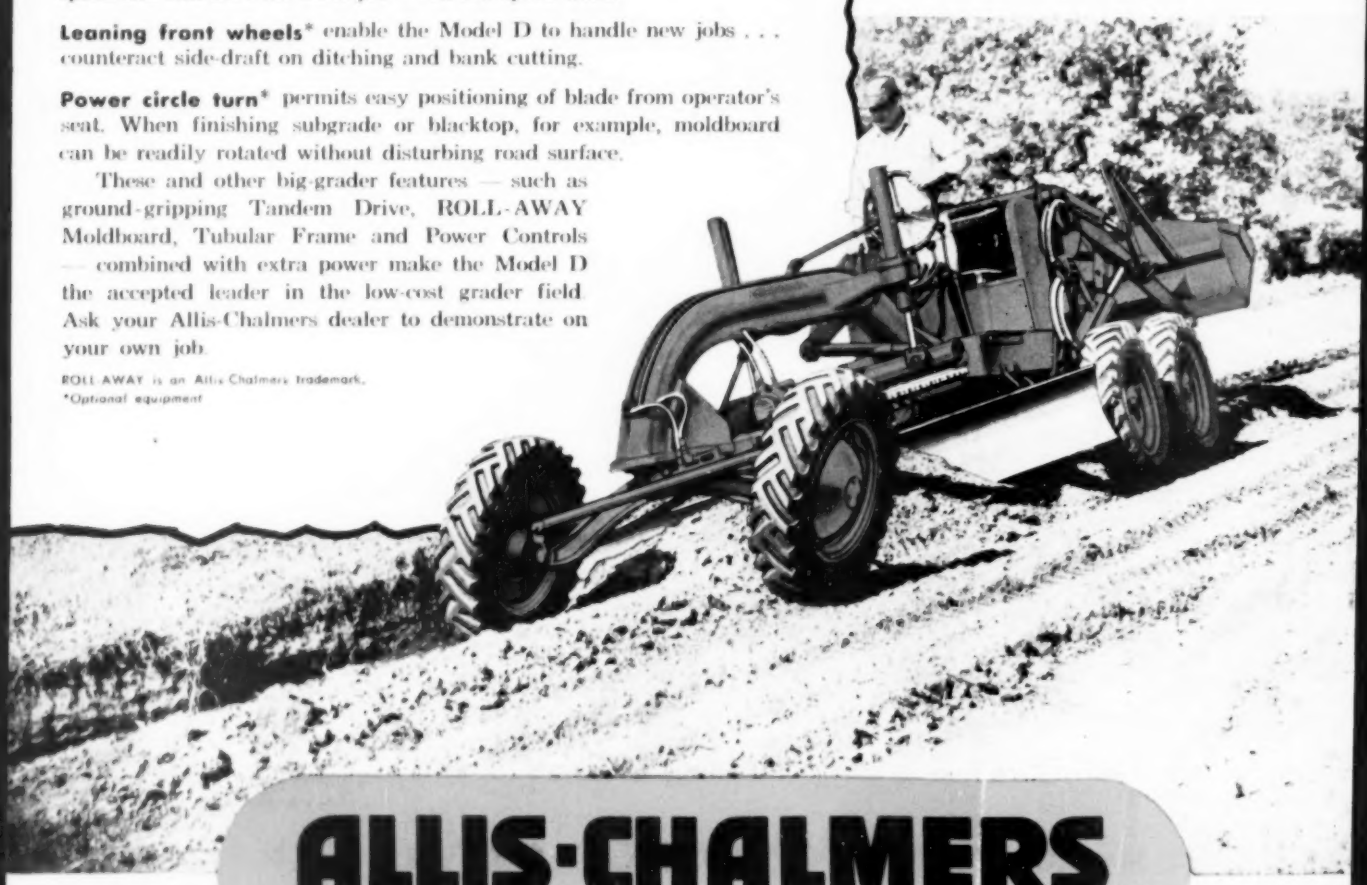
These and other big-grader features — such as ground-gripping Tandem Drive, ROLL-AWAY Moldboard, Tubular Frame and Power Controls — combined with extra power make the Model D the accepted leader in the low-cost grader field. Ask your Allis-Chalmers dealer to demonstrate on your own job.

ROLL-AWAY is an Allis-Chalmers trademark.
*Optional equipment

POWER-CRATER Engine brings *truly modern* power to the Model D

This new engine boosts power while using less fuel per horsepower. It obtains high-octane performance when using regular gasoline. Only by watching a new Model D work can you fully realize what this truly modern engine adds to its performance!

Weight: 8,800 lb. (bare) • Brake Horsepower: 50
4 Speeds forward to 25.6 mph.
Reverse Speed 3.3 mph.



ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Only 2 Field Joints Needed for this 42-ft Sheet Steel Culvert

Three 14-ft sections of 18-in. diameter, galvanized-sheet-steel culvert pipe can be assembled into a 42-ft culvert with only two simple field joints. And it can be done in a few minutes.

Compare this with the number of joints and man-hours required to assemble an equivalent culvert of any other material.

Further, these sections of 18-in. pipe are made of 16-gage sheet, and they weigh about 214 lbs each. This means that they can be unloaded and placed in a trench by two men without the aid of special lifting equipment.

A MORE FLEXIBLE CULVERT PIPE

Pipe made from corrugated steel sheet is strong, flexible and tough, regardless of diameter. It will conform to grade and alignment without pulling apart. It can absorb changing loads caused by shifting or freezing soil.

Bethlehem does not fabricate culvert or drainage pipe, but does manufacture the Beth-Cu-Loy galvanized corrugated and flat steel stock used by pipe fabricators. This copper-bearing steel meets Federal specifications, as well as those of the American Association of State Highway Officials.

The heavy zinc coating and the copper in Beth-Cu-Loy sheets provide a double defense against rust. Their corrosion-resistance is excellent. Pipes made of this steel can be expected to give many years of trouble-free service.

Any Bethlehem sales office will gladly furnish detailed information.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETH-CU-LOY *GALVANIZED* CULVERT SHEETS

ROADS AND STREETS

NOVEMBER, 1953 • VOL. 96 • No. 11

Roads and Streets represents 61 years of continuous publishing in the highway field; combined with Engineering & Contracting and Good Roads Magazines, established in 1892

HAROLD J. McKEEVER, Editor-in-Chief
C. T. MURRAY, Managing Editor

ECA

COL. V. J. BROWN, Vice Pres. and Coordinator
J. C. BLACK, Associate Editor

A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations, and to the construction and maintenance of airports.

Coming Articles

Concrete Joint Sawing

How joints are being sawed—results and costs—will be reviewed in two forthcoming articles. One on a Freeway job in Los Angeles, and one covering the big new apron at David Monthon airbase at Tucson.

Modernizing U. S. 20

New York state recently finaled three contract sections on this busy up-state arterial, designed to widen the roadbed, cut down summits and add to traffic capacity and safety.

Limited Access Design

The application of "freeway" or expressway design principles on rural arterial routes, as well as through and around cities, is the next great forward step in U. S. highway development. A series of articles on this subject is planned. One will tell of Oregon's 300-mile limited access program for U. S. 99.

Blending Pit Gravel

How a Minnesota contractor made skillful use of dozers to blend material from a badly stratified glacial pit, so that the crusher could turn out a uniform specification product with minimum trouble and waste.

Also Coming Soon . . .

Methods used to repair concrete pile trestle across large bay. . . How Texas engineers interchange ideas and results on methods developed in the various districts. . . Notes on the AASHO meeting at Pittsburgh, and on the Public Works Congress at New Orleans. . . Minnesota's $2 million road joint renovation program. . . Indiana's concrete-and-asphalt test road, construction methods.

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GILLETTE PUBLISHING COMPANY
Publication and Editorial Offices
22 West Maple Street, Chicago 10, Ill.
HALBERT P. GILLETTE, President and Publisher
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HALBERT S. GILLETTE, Vice-President and Assistant Publisher

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Roads and Streets Acceptance under Section 34.64 P.L.&R., Chicago, Illinois. Published monthly. Subscription price $5.00 per year.

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WHAT ARE YOUR BEST BUYS IN TIRES ?

All-Weather, Sure-Grip—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

To be a "BUY," a tire must take your toughest jobs in stride. It must show you more profits in more work well done. It must live a long useful life—with minimum down time for *any* reason.

Here's why so many contractors say the best tire buy is a Goodyear:

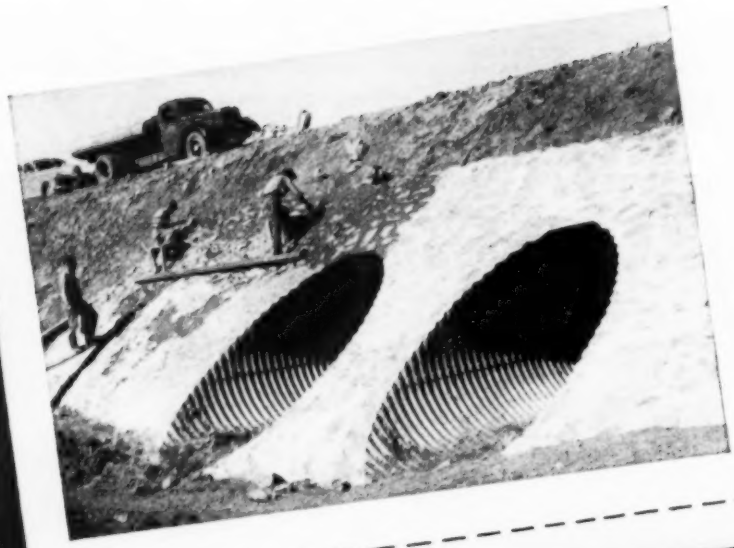
Goodyear has built and sold over 600 million pneumatic vehicle tires *alone*—more tires for more specific uses than anyone else on earth. That is because the public has learned from experience that Goodyear tires are standout in all-round performance—*that Goodyears give you extra dependability, extra safety, extra mileage!*

So when you buy or specify Goodyear, you get all this EXTRA value without extra cost! Let your dealer prove it to you. Goodyear, Truck Tire Dept., Akron 16, Ohio.

FOR EACH JOB, THERE'S A COST-CUTTING GOODYEAR TIRE!

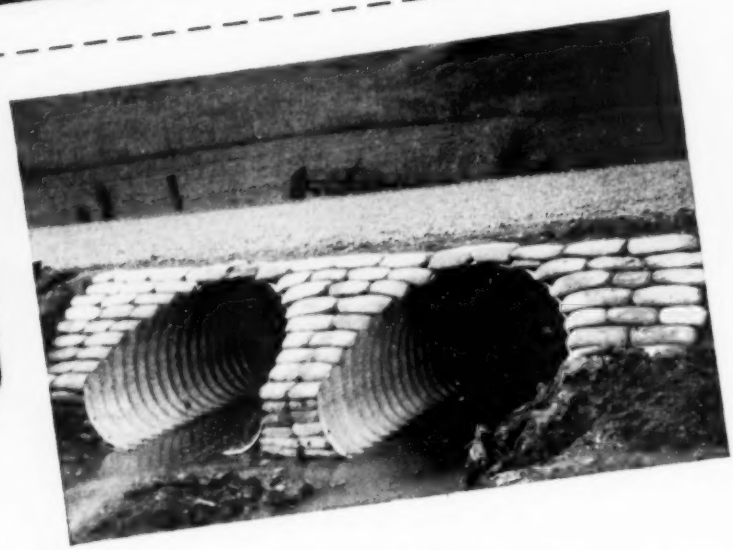
GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND



Bury Your Bridges

to make them better



Here is the way to bury your bridge problems once and for all. Armco Drainage Structures will provide adequate waterway area and let you enjoy all the advantages of building your highways and streets on solid ground.

Armco structures have the flexible strength of corrugated metal design. They will handle any load that travels your road. Equally important they are fireproof and practically maintenance-free. Long, dependable service is assured. Today there are thousands of installations, and earth fills up to 100 feet are not uncommon.

There is a type of Armco structure to meet every drainage problem. Standard, round corrugated metal pipe is ideal for smaller culverts; where headroom is limited Armco Pipe-Arch provides efficient drainage; and Armco MULTI-PLATE Pipe and Pipe-Arch extend the advantages of corrugated metal design into the larger sizes.

You also select the material durability best suited to service conditions. Plain galvanized is economical for normal service. Additional protection is obtained by adding a bituminous coating. Where severe corrosion is a problem there is Armco ASBESTOS-BONDED. For erosion Armco PAVED-INVERT offers utmost protection. A wide range of sizes meet your needs.

Use Armco Drainage Structures for dependability and economy. Write for data. Armco Drainage & Metal Products, Inc., 2493 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO DRAINAGE STRUCTURES

ARMCO

Why Sellin Bros. are sold on **CAT*** performance

Harold and Roy Sellin, Hawley, Minn., are strong for the D8 Tractor and No. 80 Scraper. They say: "For success in earthmoving, buy Caterpillar!"

Building a mile of farm-to-market road near Hitterdal, Minnesota, Sellin Bros. made excellent time in spite of wet, boggy conditions. Their equipment on this job included four Caterpillar D8 Tractors and two No. 80 Scrapers.

The big units averaged 6 round trips per hour, carrying loads up to 22 cubic yards of heavy material, over a haul distance of 500 feet. Together the scrapers moved about 3,000 cubic yards in a 12-hour day. The earth handled was black loam and heavy, wet clay, and part of the haul was through standing water

Here's what Harold and Roy Sellin say about their machines: "Caterpillar equipment is the best made, and durability is the outstanding feature. The No. 80 Scrapers load much faster and easier than other makes of machines, and production is higher."

When you're buying a scraper, look at your *last* cost *first*. Compare the Cat No. 80 or the new No. 90 with any other make on cost per yard. Then figure the cost of repairs and down time. You'll find Caterpillar Scrapers not only *outperform* but *outlast* other makes, in every kind of going.

Your Caterpillar Dealer will give you a demonstration right on your own job—*prove* that the big yellow rigs will produce more, in less time, at lower cost. Call him today!

Caterpillar Tractor Co., Peoria, Ill.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

ON JOBS LIKE

The Texaco Simplified Lubrication Plan saves time, mistakes and money

THE BIGGER THE JOB, the more you need the Texaco Simplified Lubrication Plan. It enables you to *handle all your major lubrication with no more than six Texaco Products!* The following comments by contractors are typical:

"The time and confusion saved by the Texaco Simplified Lubrication Plan are incalculable."

General-Shea-Morrison Co.,
Hungry Horse Dam, Montana

"By reducing the number of lubricants we have to use, we have substantially reduced the chance of error in application, and have speeded our maintenance work . . . keeping our equipment on the job and our maintenance costs low."

Chief Joseph Builders,
Chief Joseph Dam,
Bridgeport, Washington

"The saving of time and elimination of guesswork . . . were important contributing factors in completing the contract on schedule."

J. M. Corbett — M. J. Boyle Co.,
O'Hare Field Base Extension,
Chicago, Illinois

A Texaco Lubrication Engineer will gladly develop for you a Texaco Simplified Lubrication Plan exactly suited to your equipment and operating conditions. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

HUNGRY HORSE DAM

A. E. McCloud Photo—Bureau of Reclamation

Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

You Can Dig and Bulldoze with HYSTAWAY!

Hystaway boom can be removed in *minutes*, keeping mast in place, for extensive bulldozing work. Or the Hystaway, including mast, can be removed in less than one hour, if desired. Remounting is just as easy and fast.

. . . and that means getting jobs done *faster* with less equipment

HYSTAWAY® is the *only* machine that performs excavator-crane work as well as bulldozing and other tractor service. The *only* excavating machine that keeps productive *all* the time. Because when HYSTAWAY isn't digging, it can backfill or do other bulldozing jobs by simply turning around and using the bulldozer. For extensive bulldozing, or other tractor work, the Hystaway can be removed from the tractor in a matter of minutes. It can then be remounted, when needed, in a short time. This means you get *more* out of your equipment investment; more profit from every working hour.

Other important Hystaway advantages: No tail swing, permitting digging against fences, walls and in other close quarters; heavy-duty diesel tractor engine power for faster digging; crawler tractor mobility and maneuverability. Hystaway can be mounted on new or *used* Caterpillar track-type tractors. Hystaways are in service all over the world. There is no other *machine like Hystaway!* Get full details from your Caterpillar-Hyster Dealer or write for Catalog 1235 to:

HYSTER COMPANY

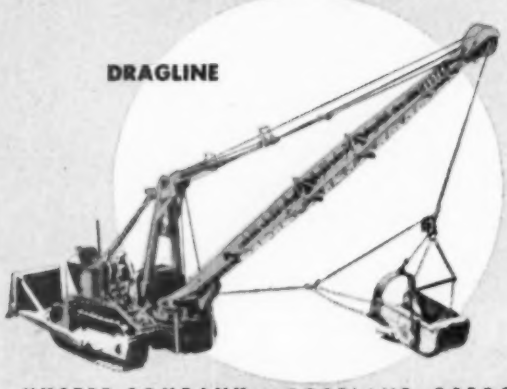
2995 N. E. Clackamas St.
Portland 8, Oregon

1895 N. Adams St.
Peoria 1, Illinois

HYSTER

THERE'S PROFIT IN HYSTER POWER

ONLY HYSTAWAY OFFERS ALL THESE MACHINES IN ONE!



1. DRAGLINE
2. SHOVEL
3. BACKHOE
4. CLAMSHELL
5. CRANE
6. PILE DRIVER
7. PLUS BULLDOZER

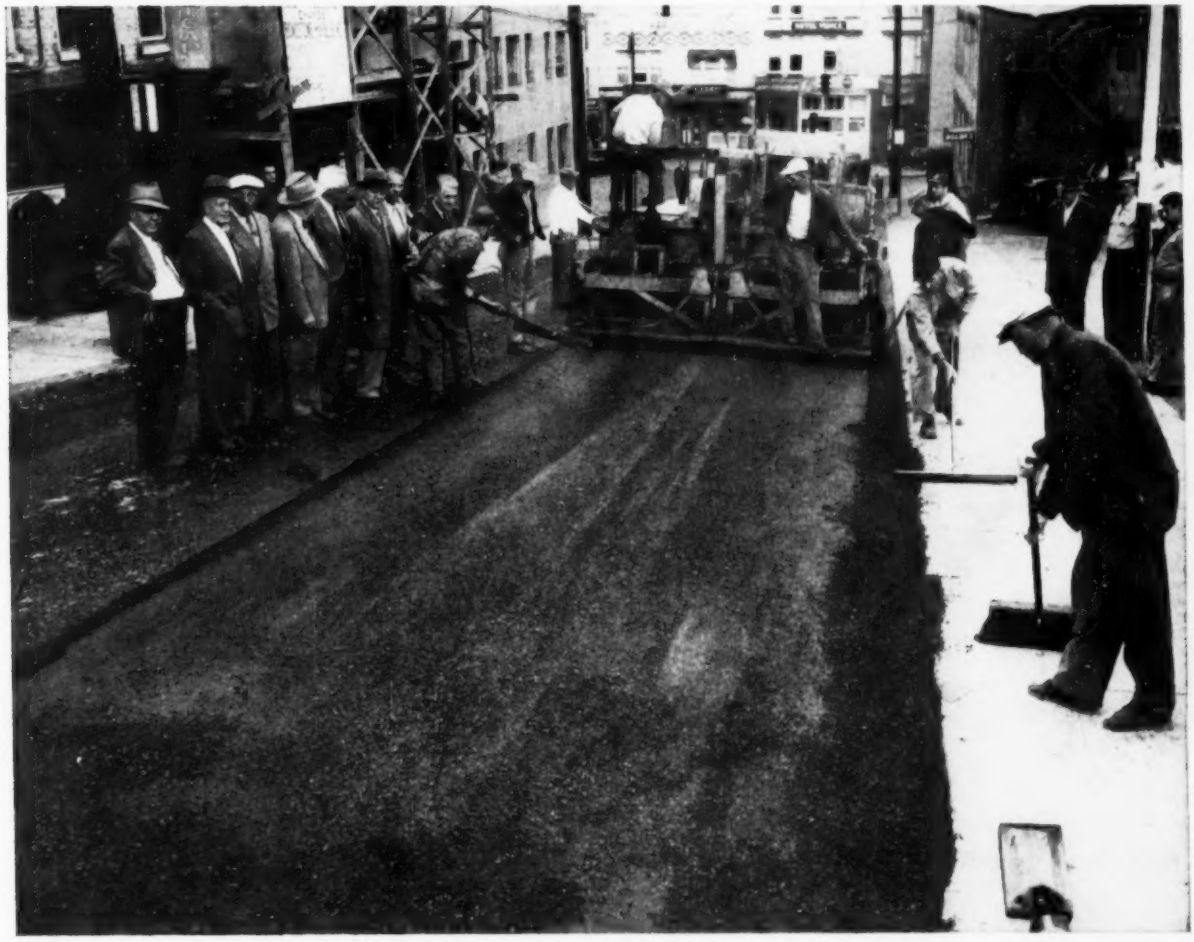
HYSTER COMPANY • PORTLAND, OREGON; PEORIA, ILLINOIS; NIJMEGEN, THE NETHERLANDS

. . . Another Street with Natural Rubber

From Seattle to Miami, from Los Angeles to Newfoundland, more and more stretches of natural rubber pavement are being laid by city engineers.

Natural rubber roads are today's fastest growing and most promising new highway development. Engineers everywhere are putting down test strips, because laboratory and in-place studies indicate that natural rubber roads will last longer, require less maintenance, and aid greatly in stretching their burdened highway budgets.

You can get complete information about laying a test strip of natural rubber-asphalt road from the Natural Rubber Bureau in Washington, D. C. This Bureau not only maintains the most complete laboratory for testing rubber-in-asphalt mixes but also has available a staff of trained field engineers to assist you in planning and installing test strips of natural rubber roads.



An array of interested officials look on as Pottsville becomes the first town in Pennsylvania to pave a block with natural rubber-asphalt mix. The experimental stretch was put down in September, under the guidance of Natural Rubber Bureau highway engineers.

Natural Rubber Bureau

1631 K Street, N. W., Washington 6, D. C.

Natural Rubber Bureau Research Laboratory, Rosslyn, Virginia

If you want help in laying a stretch of natural rubber road, or further information, write today.

☆ ANNOUNCING NEW ☆

DODGE "Job-Rated" TRUCKS

Brilliant new design opens new era in trucking!

☆ **Compare their new comfort!** ☆ **Test their new handling ease!**
☆ **See their new low work-saving design!**

2 GREAT ENGINE LINE-UPS! In addition to cost-cutting 6's, Dodge now offers the most powerful V-8 engines of all leading trucks! Available in 1½-, 2-, and 2½-ton models . . . standard in 2¾-, 3-, 3½-ton! Revolutionary hemispherical combustion chamber for high efficiency! Get free book on engine efficiency and its importance to you at your Dodge dealer's!

OVER 75 NEW FEATURES! Spectacular low-built lines! New increases in G.C.W.! New cab sealing against dust, drafts! Nonskid running boards!

PLUS famous Dodge features like . . . completely rustproofed sheet metal . . . moistureproof ignition! Truck-o-matic transmission with gyrol Fluid Drive, available!

New! Even greater values . . . yet still priced with the lowest!

New! Sharper Turning! New steering system for the shortest turning of all leading trucks! New shorter conventional tractors! New, one-piece windshield! More total vision area than any other popular make!

New! Smarter Styling! New colors! New flow-line design, featuring integral fenders, sparkling chrome! New two-tone interior styling! New wider doors! New easy-chair seats! New instrument panel.

New! Lower Lines! Pick-up and panel floors knee-high for loading ease! Lower running board for easier entry! Lower hood for greater visibility! New, low center of gravity for road-hugging stability!

SEE YOUR FRIENDLY DODGE DEALER!

22 HEILINERS

NEW JERSEY

SPEED EARTHMOVING ON THE GARDEN STATE PARKWAY

BIG earthmoving jobs like the $300,000,000 Garden State Parkway, and big-producing Heiliners just naturally go together. Heiliners combine all the advantages of fast loading, big capacity, plenty of power, high speed, and "tilting floor" positive forced ejection (the simplest and most efficient known!) with a host of other features that pay off in profit on any job.

- **8 HEILINERS for GEORGE M. BREWSTER & SON, INC.** of Bogota, N.J. are operating near Red Bank, N.J., moving over a million yards of sandy clay loam at a rate of 225-cu. yds. per hour per machine. Loading time per unit averages 45 seconds in 60 ft. and the 1200-ft. round trip time average is 3 to 3½ minutes.
- **5 HEILINERS for CONSTRUCTION AGGREGATES CORP.** of New York are moving 112-cu. yds. of sand per hour per unit on the section of the Garden State Parkway south of Morganville. Loading time averages 40 to 65 seconds in 200 ft., and average cycle time for the 8400-ft. round trip is 8 minutes.
- **4 HEILINERS for FRANK STAMATO & CO.,** of Lodi, N.J., are working near Eatontown and in Ocean County where the contractor had to meet a variety of tough conditions ranging from very wet to dry sand and gravel.
- **3 HEILINERS for J. F. CHAPMAN & SON** of Hillside, N.J., have contracts for grading, draining and structures near the north end of the Parkway working in material ranging from rock and shale to sand and gravel.
- **2 HEILINERS for REID CONTRACTING CO.** of Woodbridge, N.J., are operating near Toms River, and have a lot of tough conditions to meet such as a high water table, sand and gravel with clay and new haul roads.

THE HEIL CO.

DEPT. 4113, 3004 WEST MONTANA ST., MILWAUKEE 1, WISCONSIN

Factories: Milwaukee, Wis. — Hillside, N. J.

Sales Offices: New York, Union, N.J., Washington, D.C., Atlanta, Cleveland, Milwaukee, Detroit, Chicago, Kansas City, Denver, Dallas, Los Angeles, Seattle; Rio de Janeiro, Brazil

R-20

18 and 10-yd. Heiliner Scrapers | Steyr. Heiliner Bottom Dump Wagon | 6, 9, 11 and 16-yd. Tractor Drawn Scrapers | Cable Power Control Units

Whether it's a tough crushing job in COLORADO

THEY ALL LIKE THE BIG-PRODUCTION FEATURES OF

This unit is operated at a capacity of 100 tons per hour, crushing 75% of materials to 100% passing 3/4" screen. During 1952, we crushed slightly in excess of 150,000 tons of material. The rattler test at this pit is 38.

We are highly pleased with the efficient operation of this unit, the low maintenance cost per ton, and believe it to be the most efficient type of crushing unit for our operations.

Very truly yours,

KARL F. HEHL ENGINEERING CO., INC.

By: Karl F. Hehl.

Karl F. Hehl, President

A HEAVY CRUSHING JOB IN COLORADO
for
KARL F. HEHL Engineering Co., Inc.

FOR BIG-VOLUME AGGREGATE PRODUCTION

TAKE a good look at the production shown above in the letter from Karl Hehl of Adams City, Colorado. That's what you'd call a really tough crushing job . . . and they're getting 100 tons per hour from their Cedarapids Junior Tandem! No wonder the Karl F. Hehl Engineering Co., and all the other Cedarapids owners, are "highly pleased" with the production performance and low maintenance costs of their Cedarapids equipment.

Wherever you have a crushing and screening job . . . from Maine to California, or from the border to the gulf, in Canada or any place else on earth . . . in any kind of rock or gravel . . . there's a size and type of Cedarapids equipment built to produce *any* quantity, *any* specification . . . and at the lowest possible cost per ton. Your Cedarapids distributor will gladly help you select the plant or separate unit that will do the most for you. Remember, he's an expert in solving crushing and screening problems.

THE **IOWA** LINE *of Material Handling Equipment Includes:* ROCK AND GRAVEL CRUSHERS • BELT CONVEYORS • STEEL BINS • VIBRATOR AND REVOLVING SCREENS • UNITIZED ROCK AND GRAVEL PLANTS • FEEDERS • PORTABLE POWER CONVEYORS • PORTABLE AND STATIONARY STONE, GRAVEL AND SAND PLANTS • REDUCTION CRUSHERS • BATCH TYPE AND VOLUMETRIC TYPE ASPHALT PLANTS • DRIERS • DUST COLLECTORS HAMMERMILLS • WASHING PLANTS • VIBRATING SOIL COMPACTION UNITS • DOUBLE IMPELLER IMPACT BREAKERS

or bituminous mixing in OKLAHOMA...

CEDARAPIDS EQUIPMENT

Some of the points that make us a satisfied Cedar Rapids owner are:

Model "E"

1. Rate of production of 135 Tons per hour even under adverse conditions.

2. Versatility as to starting and stopping on City work and changing type of specifications mix with practically no delay. This is very important on a City plant that furnishes Hot Mix Asphaltic Concrete, Sheet Asphalt or Hot Mix Cold Lay Maintenance Asphalt, all during the same day.

3. Our records show that our maintenance cost for the first 120,000 Tons has been 3.1 cents per ton.

4. During the first year of operation we were never down, over two hours, due to plant failure.

MODEL "FA"

1. Rate of production on first job of 84 Ton per hour

2. No information available yet on maintenance, but if it continues at its present rate, it will be comparable to the Model "E"

We feel that our combination of big production "E" and high portability "FA" will put us in good shape to bid on big jobs that would require 90 to 215 tons per hour or small jobs where 60 to 90 tons per hour would be sufficient.

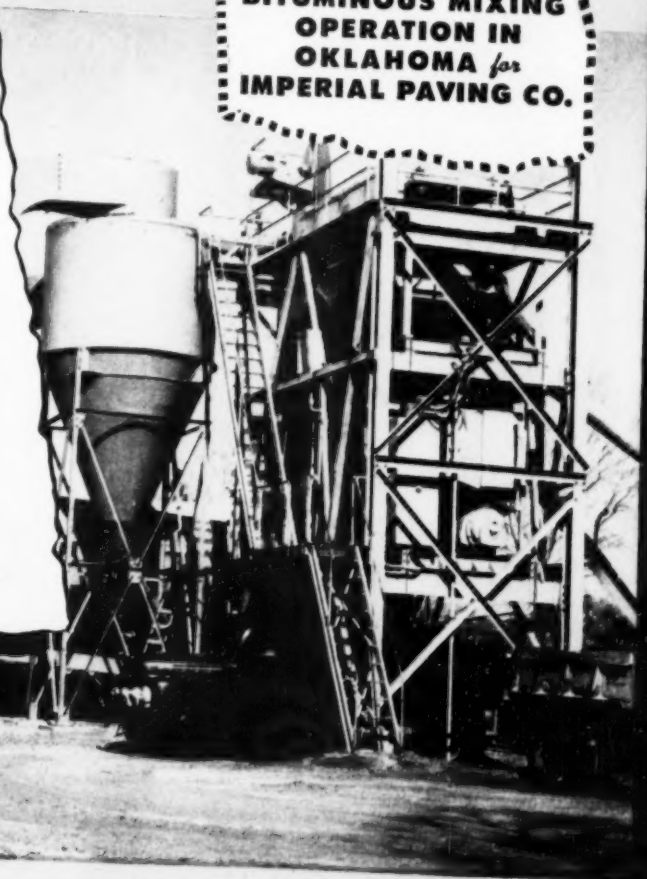
Very truly yours,

IMPERIAL PAVING COMPANY

By John W. Kelly
Member of Firm

Encls

VERSATILE BITUMINOUS MIXING OPERATION IN OKLAHOMA *for* IMPERIAL PAVING CO.



Cedarapids
Built by IOWA

FOR PROFITABLE PRODUCTION OF ASPHALTIC CONCRETE

AFTER a survey of various plants and important bituminous mixing operations, Imperial Paving Co., of Oklahoma City, chose a Cedarapids 4000-lb. all-electric Model E. As a result of their last season's production of 120,000 tons of asphaltic concrete, at a 135 ton per hour clip . . . *with only two hours downtime* . . . they purchased a Cedarapids Model FA all-electric batch type plant for operation on smaller jobs at Altus, Oklahoma. According to John W. Kelly's letter shown above, Imperial Paving is ready for any size bituminous concrete job that comes along.

Why don't you check around your territory to watch bituminous mixing plants in operation? Talk to Cedarapids owners about profitable production, versatility, low maintenance . . . then see your Cedarapids distributor for recommendations on the best plant for your job.

IOWA MANUFACTURING COMPANY

Cedar Rapids, Iowa, U. S. A.

You Can Bid this Job *and make a Better Profit* with a BUTLER Roadbuilders Plant

When you own a BUTLER ROADBUILDERS Plant — you know that there is no production limitation except the rate at which you can bring trucks to the batchers.

You see, trucks never wait at a BUTLER PLANT. That's just one reason your ownership of a BUTLER ROADBUILDERS setup virtually guarantees you an extra—and substantial profit!

Send for this BUTLER ROADBUILDERS Bulletin. Shows modern aggregate and bulk cement handling equipment built by BUTLER for every size of paving job.

BUTLER BIN COMPANY

959 BLACKSTONE AVE.,
WAUKESHA, WISCONSIN

"Gradall worked more hours than any other machine on the job!"

Mr. G. F. Howard
G. F. Howard Construction Company
Canfield, Ohio

HERE'S what Mr. Howard told us, "Gradall gathers all the loose ends together on my construction jobs. On my Route 46 contract near Columbiana, Ohio, the Gradall worked more hours than any other machine on the job. Gradall has proved itself to be a real money-maker. Why I didn't buy one sooner, I'll never know!"

This is typical of the experiences of other Gradall owners from coast to coast. They report their Gradalls handling more and more jobs, putting in 1800 to 2000 on-the-job hours every year, doing short-run jobs profitably, eliminating hand labor.

The multi-purpose Gradall's fast attachment changes, mobility, and ¼" accuracy enable owners to bid on more jobs—to make bigger profits.

But prove it for yourself. Your nearest Gradall Distributor will be glad to give you a field demonstration on your own work—to show you how Gradall can make more money for you!

Now one machine does all these jobs!

- Trenching and backfilling
- Excavating
- Placing tanks, culverts, curbs, etc.
- Sloping and grading
- Ditch digging and cleaning
- Ripping and loading old pavement
- Hand labor finishing and clean-up

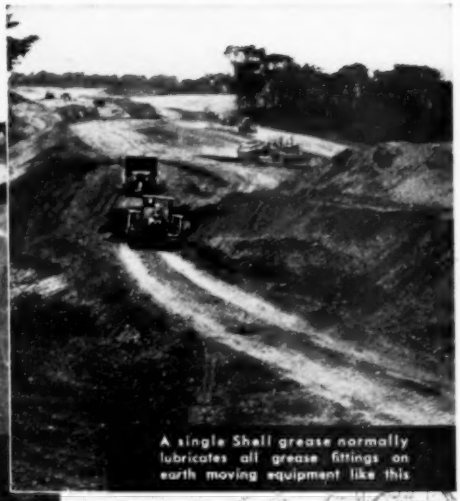
Gradall Distributors in Over 75 Principal Cities in the United States and Canada

Gradall
DIVISION OF WARNER & SWASEY Cleveland

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

On the New York State Thruway

Shell crankcase lubricants keep heavy duty tractors on the job for S. J. Groves & Sons: 3,000,000 cu. yd. grading and paving contracts



A single Shell grease normally lubricates all grease fittings on earth moving equipment like this

Severe operation causes no motor problem with Shell Heavy Duty oil in the crankcase

Shell E. P. Gear Lubricant takes the punishment during rough going on steep grades

Arute Bros., Inc. depend upon the "stay-put" qualities of Shell's Multi-Purpose Grease for continuous heavy duty work

... 1 out of every 3 construction miles uses SHELL PRODUCTS *exclusively*

That's just one way of saying that Shell has been awarded contracts by companies responsible for building sections of the New York State Thruway totaling over one third of the entire mileage. And the contracts are still coming in!

Trucks, shovels, dozers, graders . . . all equipment run by gasoline or diesel engines on those long stretches of highway construction . . . benefit from the outstanding performance of Shell heavy duty lubricants.

Products that can win the unqualified preference of such responsible and efficient operators must have what it takes . . . and Shell products *have* it . . . plenty!

Most popular on the Thruway, and equally popular wherever heavy duty engines operate, Shell lubricants keep on protecting, defying wear, and keeping maintenance costs at rock bottom. Why not specify Shell for your equipment?

2½ cu. yd. Shovels thrive on Shell Heavy Duty Lubricants under extremes of load conditions

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, N. Y.
100 BUSH STREET, SAN FRANCISCO 6, CALIF.

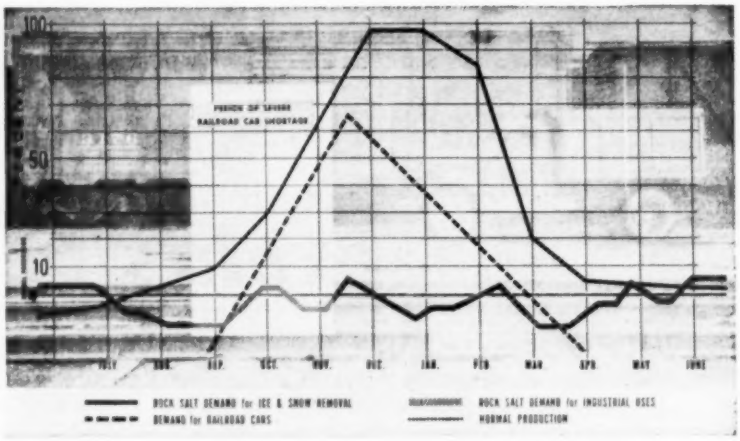
SHELL

Cayuga Rock Salt

Don't wait till snow falls and delivery's SLO!—With SALT, RAYN-SHED, TARCO, be ready to GO!

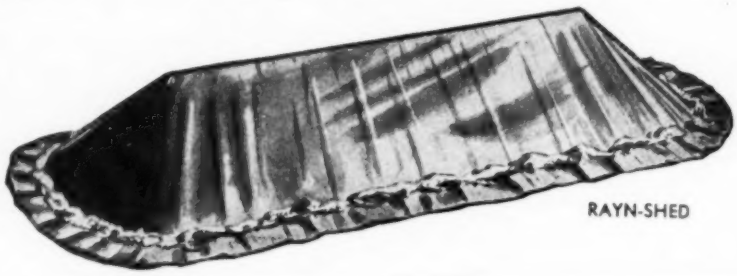
Better buy your supplies Before the snow flies!

If you wait until fall or winter, when transportation loads are at their peak, delivery may take 12 weeks or more. Look at the chart. Note the terrific demand for Rock Salt from September to March. Note also the shortage of freight cars during October, November and December. December's the month when you'll be wanting your Rock Salt in a hurry, to prevent costly skids on icy pavements. So—to be on the safe side, lay in your supplies of Rock Salt NOW.



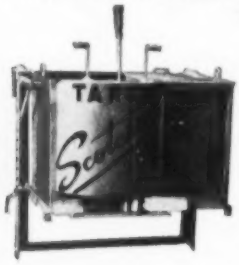
Put your Rock Salt to bed In a handy RAYN-SHED

Stored under RAYN-SHED, your salt will be kept in good condition ready for immediate use when needed. RAYN-SHED is a durable, watertight, weather-resistant vinyl-ite plastic sheet. Standard-size strips, sewed together, will cover salt piles of from 2 to 20 carloads.



RAYN-SHED

To SPREAD salt, all say This machine's the best way



For correct application of Cayuga Rock Salt we recommend the TARCO "Scotchman" Salt Spreader. Apply 300 to 400 pounds of salt, depending upon road conditions, and you'll be amazed at how fast you obtain bare, safe pavements.

COMPARATIVE COSTS OF PROTECTING ICY HIGHWAYS

With TREATED SAND (Sand mixed with sodium chloride)		With CAYUGA SALT	
Cost per cubic yard:		Cost per 5-ton load:	
Royalty	$0.10	5 tons bulk salt at $12.95 per ton	$64.75
Loading	.25	Loading, 5 tons at 25c per ton	1.25
Haul, 5 miles at 8c	.40	Average haul, 5 tons, 30 miles at 8c per ton mile	12.00
Piling with bulldozer	.15	Spread (mechanical) 5 tons at $1.00	5.00
Treating with salt (50 lbs.)	.48	Total cost per 5-ton load	$83.00
Reloading at time of storm	.25	This is the cost for 25 miles of road	83.00
Average haul, 10 miles at 8c	.80	Cost per mile ($83.00 divided by 25)	3.32
Spread	.10		
Total cost per cubic yard	$2.53		
Cost per mile (3 cu. yd. at $2.53)	7.59		

$7.59 cost per mile with treated sand
3.32 cost per mile with Cayuga Rock Salt

$4.27 SAVINGS per mile with Cayuga Rock Salt

This report is from F. Ray Williams, Superintendent of Highways, Saratoga County, N. Y. Total mileage of state highways in this county: 216 miles. Estimated savings, each storm, 216 x $4.27, or $922.32.

CAYUGA ROCK SALT CO., INC., MYERS, N. Y.

SIZES FOR ALL PURPOSES — *Call Nearest Distributor* — **BULK OR BAGS**

Atlantic Salt Company
Pier One—Northern Av.
Boston, Massachusetts
Phone: Liberty 2-1281

L. A. Gray
West Sullivan, Maine
Phone: Sullivan 57

Barnes Salt Company
Cor. Benefit & India Sts.
Providence, R. I.
Phone: Dexter 1-7279

The Chemical Corp.
54 Waltham Ave.
Springfield 23, Mass.
Phone: 9-5601

The Chemical Corp.
Pittsfield, Mass.
Phone: 2-0718

The Chemical Corp.
Hartford, Conn.
Phone: 6-3223

The Chemical Corp.
80 Boylston St., Boston
Phone: Liberty 2-7171
Nights & Sundays
Bolton—128

The Chemical Corp.
107 Franklin Street
Concord, N. H.
Phone: 1591

The Chemical Corp.
169 Front Street
Building 29
South Portland, Maine

Chas. Schaefer & Son
304 Meserole Street
Brooklyn 6, New York
Phone: Hyacinth 7-2460

Chas. Schaefer & Son
Townley, New Jersey
P. O. Box 236,
Elizabeth 3, N. J.
Phone: 2-7010

Watkins Salt Company
Watkins Glen, N. Y.
Phone: Watkins 13

Harvey Salt Company
415 Guildford Avenue
Baltimore 2, Maryland
Phone: Saratoga 5030

Southern Salt Company
222 West Main St.
Norfolk 1, Virginia
Phone: 2-4638

Salt Service, Inc.
128 E. Chelten Avenue
Reading R.R. Freight
Term. (Germantown)
Phone: Tenn. 9-6938—39
Philadelphia 44, Penn.

Industrial Salt Service
Div. H'way M'l'ls Co.
Groton, New York
Phone: Groton 134

Industrial Salt Service,
Inc., P. O. Box 115
Carlton Hills, N. J.
Phone: Rutherford, N. Y.
4-1266

Industrial Salt Service
Lehigh Salt Service
Lehigh Court (Old
L.V.R.R. Round House)
Niagara Falls, N. Y.
Phone: 4-2297

Industrial Salt Service
of Canada, Ltd.
Montreal, Quebec, Can.
Toronto, Ontario, Can.

E. J. Fedigan, Inc.
Anderson & Isabella Sts.
N. S. Pittsburgh 12, Pa.
Phone: Cedar 1-6766

Youngstown Building
Material & Fuel Co.
1505 Logan Ave.
Youngstown 4, Ohio
Phone: 3-4101

A. F. Nilson, Dist. Sales
Mgr., 12 Mercer Ave.
Chatham, New Jersey
Phone: Chatham 4-7608

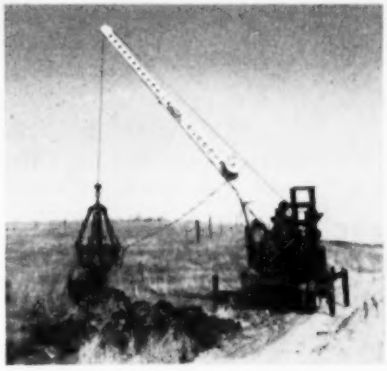
HOW *Individual Design* IN EXCAVATORS

LOWERS MAINTENANCE COSTS

Inside and out, *individually designed* Bucyrus-Erie excavators are built to last longer. Materials and construction are specified for best results in each machine's rated yardage capacity. Each part is ample to carry its share of the load and deliver long service life. All are matched for top performance.

With *Individual Design* there is no excess weight—lightness is combined with great strength. This means low maintenance, real dependability. Machinery is conveniently arranged, accessible. This means routine maintenance and servicing is fast and simple . . . saves you time and money. Steady dependable performance, day in and day out, is just one of many extra values resulting from *individual design.* Let your nearby Bucyrus-Erie distributor tell you about the many additional advantages it holds for you. See him soon!

24E53



FOR JOBS TOO SMALL for larger machines, investigate the all-hydraulic Hydrocrane. For trenching and other specialized excavating—especially when the work requires squeezing into tight places—it's the stand-out performer.

BUCYRUS-ERIE COMPANY
SOUTH MILWAUKEE, WISCONSIN

INDIVIDUAL DESIGN . . . for each model in the line
⅜ to 4 cu. yd. gasoline, diesel and single-motor electric
Shovels, Draglines, Cranes, Clamshells, Dragshovels.

ANNOUNCING . . .
FLECO PULL STUMPER

ELIMINATE STUMP AND TREE REMOVAL PROBLEMS ON RIGHT-OF-WAY CLEARING

Here is a new Fleco Product for fast, economical stump and tree removal and some types of ripping. The Fleco Pull Stumper is cable operated and designed for installation on the track type tractor.

Operating the Pull Stumper is easy and simple. Time consumed removing those hard-to-get stumps is cut to less than one-third and the operation is easier on the tractor and the operator. The tooth rips the tough lateral roots and pulls the stubborn stump out of the ground with minimum disturbance of the soil for the results of "socket stumping".

When not in use, the Pull Stumper is raised to a vertical position and held there by the cable control unit brake. It is out of the way and does not interfere with the tractor operation on other jobs not requiring the use of the Pull Stumper. If desired, the main frame can be easily detached from the tractor in a few minutes. An ideal combination for efficient land clearing is a tractor with the Pull Stumper mounted on the rear and a Fleco Rake on the front.

See your "Caterpillar"-Fleco Dealer for complete specifications covering the new Pull Stumper and other Fleco Products for land clearing.

FLECO CORPORATION, JACKSONVILLE, FLORIDA

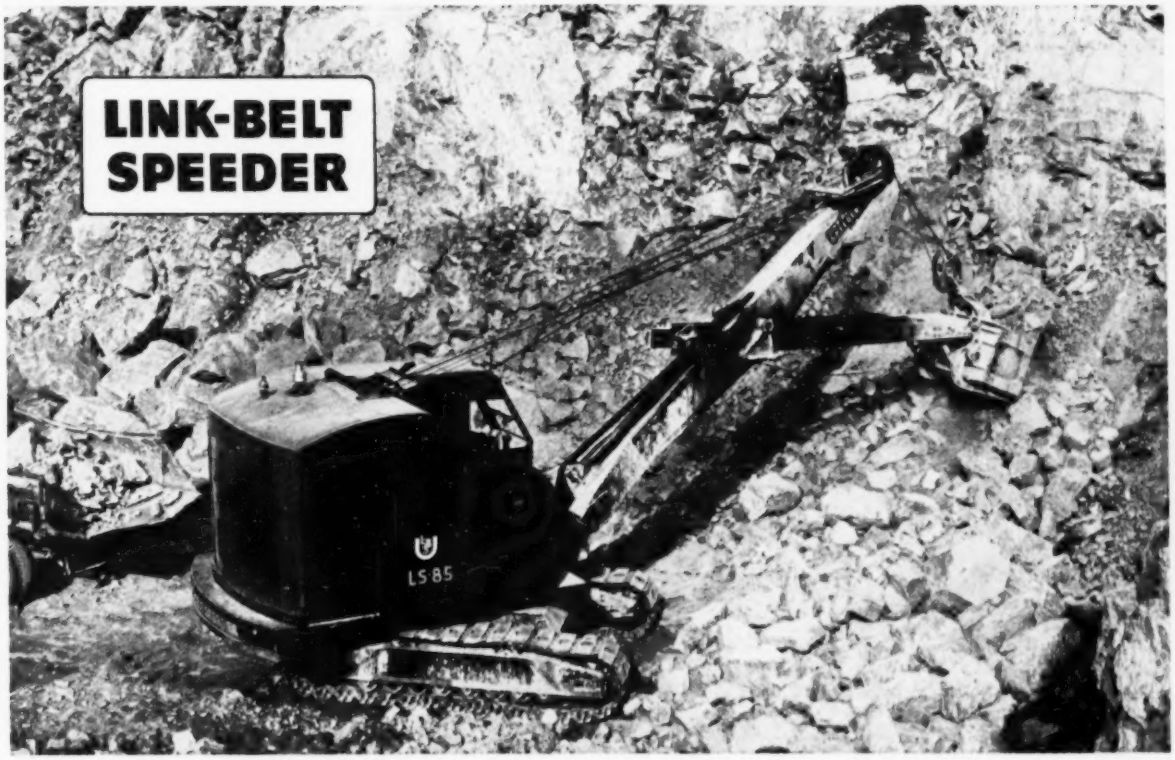
FLECO

REG. U. S. PAT. OFF.

STUMPERS • BRUSH RAKES
TREE CUTTERS • ROOT CUTTERS
ROOT RAKES • TREE DOZERS
UNDERCUTTERS • ROCK RAKES

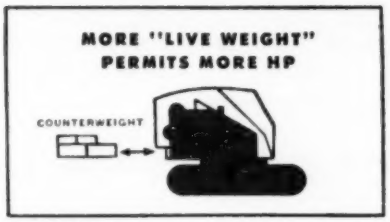
Before you buy:

COMPARE NET HP!



This LS-85, despite tough, big-chunk rock, has been operating over 1200 hours without requiring one replacement part!

Don't judge available power by engine model only ... NET hp is what adds up to extra profit!



COMPARE shovel-cranes with and without counterweight. That test spotlights the size, weight and heft built into the working parts and structural members. You'll find the LS-85 has more "live weight" than comparable ¾-yard shovel-cranes.

Greater net horsepower assures faster, deeper digging. Bigger loads are handled without stalling. For example: the diesel driven heavy-duty ¾-yard LS-85 packs 92 net hp. That's more power than comparably-sized competitive rigs can safely use. It's why the LS-85 has more digging force behind its bucket teeth . . . why it cuts so smoothly . . . hoists and swings without a pause.

Use of greater net hp is practical because of all-welded, stress-relieved construction *and extra "live weight."* This *extra live weight* is in heavier, sturdier working parts and structural members—rather than a heavier counterweight. All this means year-after-year service and low maintenance costs. So whatever you do, don't compare power by the engine model only—CHECK *NET* HP.

For more facts on the LS-85, ask your distributor, or write for Catalog 2317. For the complete line, request Catalog 2373.

LINK-BELT SPEEDER CORPORATION
Cedar Rapids, Iowa

15.740

LINK-BELT SPEEDER CORPORATION

BUILDERS OF A COMPLETE LINE OF CRAWLER, TRUCK AND WHEEL-MOUNTED SHOVEL-CRANES

FACTORY-TRAINED DISTRIBUTOR SALES AND SERVICE SPECIALISTS ...*EVERYWHERE*

U.S. ROYAL

CON-TRAK-TOR

FULL LUG

Cuts Costs for Contractors!

This is the power tire for the grueling hauls! With *triple* impact protection—extra inter-ply rubber layers, double shock-pads, rock-resister cap-plies. With *exclusive* full-lug traction that *pulls* where you used to stall. With all-around tire *economy* that starts from the hour you mount it! **Also available in Nylon for heaviest duty!**

Your U. S. Royal Dealer has complete proof—phone him today!

Speed specialized jobs with these great U. S. ROYALS!

U. S. ROYAL FLEETMASTER
Smooth rolling *on* the road, superior traction *off*. 70% more tread depth!

U. S. ROYAL ROAD TRACTION
New steering ease where most hauling is on-road at reasonable speed.

U. S. ROYAL LUG TRACTION
Best for high traction at low speeds off the road or on unimproved roads.

LATEST TIRE INFORMATION NO COST, NO OBLIGATION

Just out—new 64-page booklet—get it FREE. Includes engineering and service aids, load and inflation tables, dual matching, weight-charts, much more. Write U. S. Royal Truck Tire Department, United States Rubber Company, Dept. A, 1230 Avenue of the Americas, New York, N. Y.

U. S. ROYAL TIRES *Product of* UNITED STATES RUBBER COMPANY

GM DIESEL
CASE HISTORY No. IC9-85

OWNER: Rose Construction Co., Atlanta, Georgia

INSTALLATION: GM 2-71 Diesel, replacing a gasoline engine in ½-yd. backhoe.

PERFORMANCE: Shovel now works faster, maintains the load and doesn't stall. Previous engine was burning 35 gallons of gasoline in 8-hour day; GM Diesel uses only 6 to 8 gallons of Diesel fuel per day.

It pays to STANDARDIZE on

GM
GENERAL MOTORS
DIESEL POWER

SWITCH FROM GASOLINE TO GM DIESEL SLASHES FUEL COST

You can see from the above that it won't take long for this General Motors Diesel to pay for itself out of fuel savings alone. Add the extra work it does every day—the lower cost of maintenance—increased equipment availability—longer engine life—and you'll see why buying a GM Diesel is one of the best investments you can make.

The GM Diesel starts at the push of a button—uses fuel in direct proportion to the work it does. It gets work done faster because with 2-cycle operation it accelerates faster under load changes. And because of its smaller size, it often fits where other Diesels won't.

If you have equipment that needs new life, contact your GM Diesel distributor. He will analyze your power requirements and show you in dollars and cents how much this engine can save for you. No obligation, of course.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN
Single Engines . . . 16 to 275 H.P. Multiple Units . . . Up to 840 H.P.

STOP WASTING MONEY BY THE TRUCKLOAD

Go White!

YOU NEED the most efficient, most dependable kind of trucks for today's schedules . . . today's costs of doing business . . . today's work conditions.

That's why you see so many Whites in excavating, road-repair and maintenance service and dump operations.

Tailored to the exact needs of your work, Whites have the power and the rugged reliability to get *more* work done . . . in *less* time . . . at *lower* cost than any other truck you can buy.

Find out how Whites save money in *your* service. See your White Representative.

This WHITE Model 302264 is in road repair and maintenance service for Maricopa County, Arizona.

THE WHITE MOTOR COMPANY • *Cleveland 1, Ohio*

For more than 50 years the greatest name in trucks

Check these White advantages . . .

- √ WIDE RANGE of models to meet every hauling operation.
- √ OUTSTANDING maneuverability because of short wheelbase, wide tread front axle and short turning radius.
- √ NEW WEIGHT distribution permits larger loads within legal limits . . . extra payload . . . more work done.
- √ SINGLE drive axle units with single or double reduction or two-speed axles.
- √ TANDEM drive units with double reduction axles.
- √ SINGLE or double channel frame.
- √ TRANSMISSIONS—various transmissions and auxiliary transmissions to meet local operating conditions.

Move More with a MICHIGAN

"MICHIGAN air control and clutches make operation smooth and easy. This is our second MICHIGAN—it's definitely MICHIGAN for us!"— C. KOOISTRA, Owner

HERE ARE THE JOB FACTS

JOB . . . . . **Cellar excavation, Camp Gaw, N. J.**

MACHINE . . . . **MICHIGAN C-16 . . . hoe, 30" pads**

MATERIAL . . . . **Hard pan, stump removal**

YARDAGE . . . **400 per day**

FUEL . . . . . **10-12 gallons, 8 hours**

OWNER . . . . . **C. Kooistra, Midland Park, N. J.**

COMMENT . . . . . **"Swing, travel, hoist, steer all at once—easy! That air control and MICHIGAN clutch are tops." Cornelius Kooista (son), operator**

TO MOVE MORE YARDAGE FASTER, AT LOWER COST- Make it a MICHIGAN

These 5 cost-cutting quality advantages explain why over 60% of MICHIGANS sold are repeat orders

AIR CONTROL — just easy, effortless operation, because air rams actuate the clutches. An operator stays at top efficiency all day without tiring, because air power instead of muscle power does the work. MICHIGANS have been air controlled for over 20 years.

ONE-PIECE CIRCLE GEAR AND CARBODY—Compare MICHIGAN construction to others: the *circle gear and carbody in a single heavy alloy-steel casting.* No wonder this machine lasts longer, requires a minimum of service.

HEAVY TURNTABLE CASTING—Notice this heavy-duty construction usually found only in the biggest machines: turntable deck, side frames and hook-roller mounting brackets in a single casting—*One main cause of excessive wear and replacement completely eliminated!*

FAMOUS MS CLUTCH—Another MICHIGAN exclusive: a single-disc double-face clutch with six interchangeable segments on each face, so you can replace segments in a matter of minutes—*in the field.*

QUICK MAINTENANCE AND SERVICE—Big time savings here—grease the whole job in a few minutes, save hours. Compare MICHIGAN air control simplicity to the complicated mass of toggles, rods, joints, etc., on mechanical control. Eliminates tedious greasing.

Check the MICHIGAN Line—point by point against all others. Convince yourself—see these powerful machines in action—fast, easy, smooth. You'll see right away that *MICHIGAN Means More for Your Money.*

See your MICHIGAN dealer—
and write for literature.

CLARK EQUIPMENT Construction Machinery Division

CLARK EQUIPMENT COMPANY

480 Second Street, Benton Harbor, Michigan, U.S.A.

Big

ESTABLISHING MOUNTAIN-TOP BASE, a helicopter and a TD-24 put men, machinery and supplies on mile-high pass as first step in efforts to build road down to meet section coming up from each side. TD-24 pulled yarder, winch, and compressor into pass after bitter 7-day fight.

1 **RAISING KENNEY DAM** to fill the Grand Canyon of the Nechako River, workers sluice down some of the 3.8 million cubic yards of earth and rock it will eventually contain. Dam will form a reservoir with twice the capacity of Grand Coulee. TD-24 in foreground strips blasted rock from canyon wall abutment.

2 **HEADING OPERATIONS** at Kenney Dam are (left to right) Alcan Resident Engineer Harry Jomini; General Superintendent "Hak" Nielsen and Project Manager Jack Bremner, both of Mannix, Ltd., sub-contractor for Morrison-Knudsen Company of Canada, Ltd. 110 miles west, dammed-up waters will be diverted through mountains and dropped a half mile to run turbines in sea-level powerhouse.

3 **DRIVING TEN-MILE TUNNEL** through mountain is done from four headings. Here, half a mile above ocean-level valley, aerial tramway has delivered TD-24 to tunnel portal for working debris down mountain. 2,600 feet below, eight-story powerhouse inside mountain is being mucked out by a TD-24 and a TD-9.

Red TD 24 Pioneers New Frontier

59 International TD-24s spearhead largest integrated engineering program in history for Alcan (Aluminum Company of Canada, Ltd.) on Project British Columbia

A fleet of 59 hard-hitting International TD-24s is blazing a new frontier across 5,000 square miles of wilderness in British Columbia.

Twenty-four hours a day, they're on the go for Morrison-Knudsen Company of Canada, Ltd., prime contractor for most of the giant development that includes:

Building the largest sloping clay core dam in the world

Driving a subway-size tunnel ten miles through a mountain

Blasting out an eight-story powerhouse two blocks long inside solid rock

Erecting a transmission line fifty miles long over a jagged mountain range

Raising the world's largest aluminum smelter and a new port city at Kitimat where 50,000 people may eventually live and work.

A. O. Strandberg, project manager for Morrison-Knudsen, says:

"These TD-24s are doing the impossible. We never thought any tractor could go where these tractors are working now. They have the weight, they have the balance, and they have the power to get the job done."

And here's what superintendents on the firing line say:

Bill Richards: *"They're pushing boulders uphill we had to dynamite in the old days."*

Herb Wilkinson: *"I wouldn't believe where they'd go until I got them on my crew."*

John Hutton: *"They're doin' work up here they were never built for but they're doin' it just the same."*

Your International Industrial Distributor can give you the facts and figures on the TD-24. See him: You'll be a TD-24 man from then on in!

INTERNATIONAL HARVESTER COMPANY • CHICAGO 1, ILL.

INTERNATIONAL HARVESTER

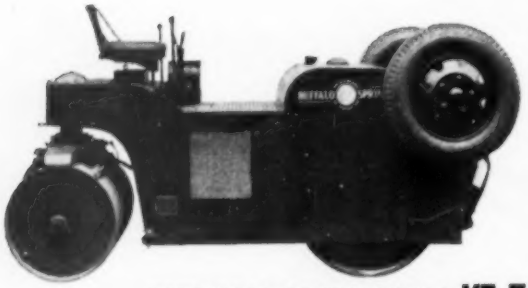
INTERNATIONAL

POWER THAT PAYS

4 INSPECTING MOUNTAIN TOP OPERATIONS at Kemano, headquarters for construction of powerhouse, tunnels and transmission line are (left to right) A. O. Strandberg, Project Manager for Morrison-Knudsen; F. T. Matthias, Alcan Assistant Project Manager, and Walter Abrahamson, Alcan Assistant Resident Engineer at Kemano.

5 LINKING UP POWER TRANSMISSION LINE ROAD, a pair of TD-24s doze toward each other through blasted rock. Across 50 miles of rugged terrain like this, a mountain-anchored powerline will be built to flash abundant electricity from mountain powerhouse to smelter at tidewater.

6 NEW LAND IS MADE IN OCEAN INLET by dredge which deepens anchorage for ocean shipping at the same time. H. M. Whiting (right), Project Manager for Kitimat Constructors, Ltd., and a superintendent study progress. Part of this 70 acres of new land will become site of new aluminum smelter. Town which may eventually become city of 50,000 will be built across the bay.



BUFFALO-SPRINGFIELD KT-7

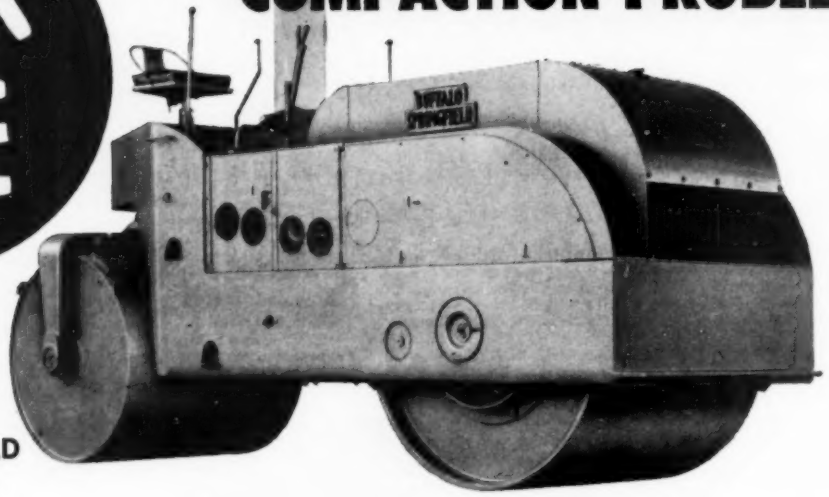
World's most useful 3-5 ton portable roller! Ruggedly built, with guide and drive rolls of heavy steel plate. Compact 4-cylinder engine delivers 24.2 horsepower through a simple, troublefree two-speed transmission and famous Buffalo-Springfield bevel gear final drive. Easily rigged for towing, has built-in hydraulic jack to raise drive roll. Ideal for driveways, parking lots, road and street maintenance. Ask for Bulletin S-58-49.

BUFFALO-SPRINGFIELD 3-WHEEL ROLLER

Heavy-duty engineered for continuous service on toughest jobs. Features that give you wide job versatility . . . Exclusive 4-speed transmission to provide a *continuous* range of roller speeds from 1.1 to 5.0 mph, *all at full engine power.* Machine-finished ballast-type rolls. High-speed, low-torque clutches for even, smooth reversing. Many more. Models for weights from 5 to 17 tons. Ask for Bulletin S-60-50.

LOOK HERE

FOR THE ANSWER TO YOUR COMPACTION PROBLEM



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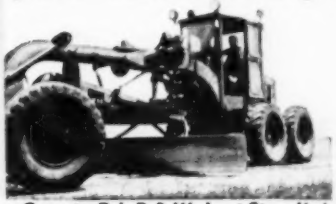

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NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

Roads and Streets in the News

Toll Road Bond Issue Plans Involve Large Total

The following round-up brings readers fairly up to date on the swift-changing toll road picture [*See July and August Roads and Streets for earlier reports*]

ABOUT $700,000,000 will be sought from investors in the immediate future for new or additional financing of toll highway construction projects in Indiana, Massachusetts and New Jersey—with similar borrowing likely to stem later from toll road plans in a score of other states.

The Indiana Toll Road Commission announced plans to place on sale late in 1953 between $225,000,000 and $250,000,000 in toll road bonds. The Massachusetts Turnpike Authority plans to issue $200,000,000 or more such bonds. The New Jersey Turnpike Authority is expected to offer about $130,000,000 of its securities this fall while the New Jersey Highway Authority, a separate toll road agency, plans to issue another $135,000,000 in bonds around Nov. 1.

Meanwhile, bids were scheduled to be opened Sept. 15 on a new issue of $125,000,000 state-guaranteed New York Thruway Authority bonds. An initial issue of similar size was marketed last May by the authority as part of its financing of the half-billion-dollar toll superhighway now being constructed between New York City and Buffalo.

Other states which may seek new or additional toll road financing at varying future dates include Colorado, Connecticut, Florida, Illinois, Iowa, Kansas, Kentucky, Michigan, Nebraska, New Hampshire, North Carolina, Ohio, Oklahoma, Pennsylvania, Texas, Virginia, Washington, West Virginia and Wisconsin.

Toll highway projects involving total costs of $1,563,000,000 are currently under construction or getting under way in Connecticut, Maine, New Hampshire, New Jersey, New York, Ohio, Pennsylvania and West Virginia.

Engineering studies of costs and feasibility of new or extended toll highways are in progress or have been authorized by legislative or administrative action in Colorado, Florida, Illinois, Iowa, Kansas, Kentucky, Michigan, Nebraska, North Carolina, Pennsylvania, Texas, Virginia, Washington and Wisconsin.

Funds are being sought for engineering studies for a second Ohio toll highway, but new laws authorizing three more Oklahoma toll roads have been stymied by a referendum movement.

Toll roads previously constructed at a total cost of more than $600,000,000 are in operation in Colorado, Connecticut, Florida, Maine, New Hampshire, New Jersey, New York, Oklahoma, and Pennsylvania, with their revenue yields in most instances running far ahead of original expectations.

Among current and prospective developments in the field of toll highway financing and construction, on a state-by-state basis, are the following:

Florida: A syndicate of 68 Southern investment banking firms is ready to take the lead in financing a projected 110-mile toll highway from Miami to Stuart or Ft. Pierce if engineering and revenue surveys turn out favorably.

Meanwhile, Florida's Supreme Court ruled that the state's new turnpike act offers no bar to independent construction by Dade County of a toll expressway to Miami International Airport and does not prevent any other county from embarking on local toll road or bridge projects without specific legislative sanction.

Indiana: Charles Enlow, a member of the State Toll Road Commission, recently revealed that bonds to finance construction of a projected cross-state toll highway probably would go on sale late in 1954. Completion is expected by the fall of 1955. The project is expected to cost some $165,000,000, plus financing expenses.

Iowa: State Highway Commission completed arrangements for cost and feasibility studies for a proposed toll road, with a final report expected to be made next spring. The State Legislative Interim Committee voted to give $50,000 of its funds for the studies, as authorized by the 1953 legislature. The studies will be made by the engineering firms of Howard, Needles, Tammen and Bergendoff, of

Key interchange awarded for Chicago expressways

One of the most important interchange "pretzels" ever devised for facilitating urban expressway flow, is that just started near the edge of Chicago's downtown "loop" district. The first link was awarded to Herlihy-Mid-Continent Company, Chicago, on low bid of $497,841.

This structure will be located at the junction of the new west-side Congress Street expressway and the principal outlet point into the business section. An estimated 90,000 cars will use the facility daily, with 20,000 using the ramps. The initial contract calls for construction of a 330-ft. concrete structure to carry traffic over Wacker Drive and Franklin Streets. The plaza or complete exchange system will eventually include a system of curved ramps, as shown in the accompanying architectural rendering.

★ The "Loop" bound motorist in Chicago will eventually leave the expressway by this elaborate structure

Kansas City, and Coverdale and Colpitts, of New York.

Authorization for the present Iowa study was approved by the 1953 legislature as a substitute for a bill which would have created a state toll road authority, empowered to proceed with the issuance of revenue bonds to finance toll highway construction if found feasible. A previous toll road study committee disagreed in its report to the legislature.

Kansas: The State Turnpike Authority, created by the 1953 legislature, has contracted with the engineering firms of Howard, Needles, Tammen & Bergendoff and Coverdale & Colpitts for surveys of a proposed toll road from Kansas City to Topeka and then to Wichita, with a possible link with Oklahoma City later. Preliminary estimates indicate the cost of such a project would exceed $110,000,000.

Massachusetts: Controversy continuing over details of the route of the projected $200,000,000 cross-state toll road, but early action expected toward the issuance of revenue bonds to finance the project and start of construction.

Michigan: Blocked from proceeding now with a proposed toll road from Detroit to Toledo because of unwillingness of the city of Monroe to yield jurisdiction over a freeway from there to Rockwood, the Michigan Turnpike Authority turned its attention to the possibilities of toll highways from Detroit to Bay City and from Detroit to South Bend. Contracts were let for studies of the latter two projects, with initial emphasis on the Bay City-Detroit route.

William E. Slaughter, chairman of the Michigan authority, explained that Monroe insisted on completing the expressway between there and Rockwood as a separate project and keeping it a freeway. The authority had proposed to take over the freeway, converting it into a link in the contemplated Detroit-Toledo toll road. Because of Monroe's attitude, he said, the authority decided to concentrate its immediate attention on the Bay City-Detroit project.

New Hampshire: Proceeding rapidly with plans for the Central New Hampshire Turnpike from Nashua to Concord, for which the 1953 legislature authorized a $23,000,000 state bond issue. Part of the highway already has been started.

New Jersey: Expect early public offering of about $130,000,000 New Jersey Turnpike Authority bonds, of which $30,000,000 would be for refinancing purposes. The balance would be used to finance construction of a proposed 8½-mile $100,000,000 Newark Bay crossing and circumferential highway link between the New Jersey Turnpike and the Holland Tunnel.

Meanwhile, announcement was made of plans of the New Jersey Highway Authority, a separate agency, for issuance of another $135,000,000 in bonds. This would be in addition to a $150,000,000 bond issue floated in July. The authority's accelerated program calls for completion of its 165-mile, $285,000,000 Garden State Parkway by Dec. 1, 1954.

Ohio: Pending before the State Board of Control at this writing is a request for an advance of $650,000 of state funds to finance an engineering survey of the feasibility of a second Ohio toll superhighway, which would

California awards contract for Golden Gate approach

The Golden Gate bridge at San Francisco is to have its north approach revamped, as a result of the largest highway contract ever awarded by the California Division of Highways. Contractor is Guy F. Atkinson Co., of San Francisco, at $4,122,382. The cost including a second tunnel will eventually run to $6 million.

The present approach road carrying U.S. 101 and regional traffic is overloaded. Known as the Waldo project, the new facilities will provide a second parallel highway of full freeway design, with no left turns or surface crossings. As shown on the accompanying location sketch, the present road winds along the hilly Marin County terrain, passing through a tunnel near the bridge. The new road was located after much study of the problem of restricted right of way, and the final design crosses over the existing roadway at one point.

The improvement will consist of converting the existing highway to a 3-lane highway for south-bound traffic, and constructing three new lanes for north-bound traffic with curbed median throughout. The job will have two stages. The present contract will provide grade, structures and part of bases and surfacing required for traffic convenience. A second contract will complete the base, surfacing, median curb and incidental details.

Major structures will consist of a new 1,000-ft. tunnel paralleling the present tunnel, two side-hill viaducts, a new under-crossing, extensions of two existing under-crossings, and extension of a military tunnel under both roadways. Traffic interchange facilities are also involved.

Heavy grading will be required. The toe of one hillside embankment is designed to extend out a maximum of 710 ft. at elev. 300 ft. below the highway grade. The top of the cut slopes will be 630 ft. out at 290 ft. above grade. At one point 650,000 cu. yd. of excavated material must be transported across the existing highway, under traffic. This work will dovetail with construction of a new underpass that will permit part of the yardage to be carried under.

Photogrammetry was credited with major cost and manpower savings in planning the location and design of the project. Financing is through a special legislative act, calling for repayment of the state's share from Golden Gate bridge tolls.

★ Location plan of the new north approach to Golden Gate Bridge into San Francisco. New facilities shown in solid black lines

run about 300 miles from Cincinnati to Conneaut in northeastern Ohio.

Chairman James W. Shocknessy of the Ohio Turnpike Commission said he had been advised, on the basis of preliminary studies, that such a highway is "prima facie feasible." The proposed second turnpike would be about 60 miles longer than the one now being constructed from Pennsylvania to Indiana across northern Ohio.

Oklahoma: Filing of completed referendum petitions carrying 40,000 more signatures than required blocked two 1953 Oklahoma laws authorizing construction of three more toll superhighways in the state. Unless their sufficiency is successfully attacked, the petitions will suspend the laws until they are voted upon by the people.

Governor Murray had not indicated at this writing whether he would call an early special election on the issue, a special election at one of the July primaries next year, or let the proposals go on the ballot at the 1954 general election. One of the measures hit by the referendum move would authorize three more toll roads —from Tulsa to the Missouri line on the way to Joplin; from Oklahoma City north to the Kansas line on the way to Wichita, and from Oklahoma City southwest to the Texas line on the way to Wichita Falls. The other new act authorizes use of state highway funds for toll road surveys.

Pennsylvania: A proposed extension of the Pennsylvania Turnpike from a point east of Harrisburg through the anthracite region of the New York State border, in the vicinity of Binghamton, is expected to have top priority with the Pennsylvania Turnpike Commission as its next major project.

Another extension, to run from the Pittsburgh area to near Erie, may be constructed simultaneously, depending upon how fast surveys for both proposed highways can be completed.

Meanwhile, the Pennsylvania commission is proceeding with construction of a $65,000,000, 35-mile eastern extension to the Delaware River, near Edgely, from which point a connection is planned with a projected link with the New Jersey Turnpike.

Virginia: Although agreeing with officials of West Virginia and North Carolina to sponsor jointly a preliminary engineering survey of traffic in southwest Virginia, highway officials of Virginia reportedly are cool to the idea of a toll road in that area to tie in with toll road plans of the other two states. The Virginia officials are said to favor improvement of free roads as a means of handling such traffic.

The Virginia Highway Commission, however, adopted a resolution recommending that the 1954 legislature create a special toll road authority to construct and operate a Richmond-Petersburg toll road passing through those two cities. Wilbur Smith and Associates, consulting engineering firm of New Haven, Conn., earlier recommended such a project. The engineering firm, which was retained by the state, had not yet reported on its studies of highway needs in the Virginia portion of the Washington metropolitan area.

West Virginia: Revealing it will need more than available from its original $96,000,000 revenue bond issue for completion of the two-lane toll highway now being constructed between Charleston and Princeton, the West Virginia Turnpike Commission indicated that the amount of the required additional financing would be made known in October. The needs are expected to be modest and probably will not be sought until next year.

Concrete Pavement Chosen for W. Virginia Turnpike

Concrete was chosen as the pavement alternate for pavement comprising virtually the entire 88-mile 2 and 3 lane West Virginia Turnpike, at the turnpike commission's October 7 letting. As previously announced by the commission [Roads and Streets, Sept. 53], it had reserved the right to select the pavement type after receiving bids on alternate asphalt and concrete designs. These bids were received on successive weeks beginning in September.

The concrete pavement, totaling 1,564,000 sq. yd. of concrete was awarded to low bidders at a total of $19,508,000, this figure covering bids on four sections and taking in subbase, base and shoulder work as well as pavement for main roadway and ramps. This figure was 26.3 per cent above the aggregate of the four lowest bids for asphaltic pavement. Designs for both pavement systems included 24 in. of sub-base, base and pavement above template grade, to which level the grading contractors are to complete their work. The concrete bids aggregated 52.8 per cent higher considering only the 9 in. pavement plus 1 in. sand cushion, compared with the 7 in. penetration macadam base and 3-in. asphaltic concrete surface in the alternate.

In making the choice, the commission is understood to have weighed the factors of pavement life, maintenance, and safety considerations including skid-resistance, wet-weather operations and night visibility.

Bidding was spirited for both pavement types, some of the contractors bidding on more than one section and on both types of pavement. The concrete sections each received 5 or 6 bids, and the asphalt designs each from 5 to 10 bids.

The accompanying table shows the contractors who will pave the West Virginia Turnpike in 1954, together with their bid price, and the lowest bid received on the asphalt alternate. On three of the four sections the low concrete bidder was also the low asphalt bidder.

Section	Contractor	Section	S. Y. Concrete	Price	Low Asphalt Bid
29	J. B. Michael Co., Memphis, Tenn.	20.0 mi.	357,000	$4,386,000	$3,502,000
30	Nello L. Teer Company, Durham, N. C.	30.0 mi.	572,000	6,951,000	4,897,000
31	Bero Engineering & Construction Co., Hampton, Va.	16.0 mi.	265,000	3,418,000	3,027,000
32	R. B. Tyler Co. & Breslin Const. Co., Louisville, Ky.	19.7 mi.	370,000	4,753,000	4,027,000
	TOTAL	85.7	1,540,000	$19,508,000	$15,453,000

White House conference on traffic safety planned

The dates for the White House Conference on Highway Safety, to be held in Washington, D. C., have been set for February 17-18 and 19, 1954.

The Conference, organized at the White House on July 28 in response to a call from President Eisenhower, is dedicated to stimulating organized public action on the community level in efforts to reduce the traffic toll.

Civic leaders from all parts of the country will be invited to the Conference. Governors will be asked to send official representation. Delegates will be named from agriculture, business, industry, labor and women's organizations, civic and professional groups.

The preliminary organization for the Conference will be staffed by the Bureau of Public Roads in the Department of Commerce, with staff headquarters in the General Services Building, Washington 25, D. C.

A General Conference Director, to serve under Commerce Secretary Weeks, will be designated soon by the General Chairman's Businessmen's Advisory Group, which was formed at the Commerce Department following the July 28 meeting. Harlow H. Curtice, President of General Motors Corporation, is Chairman of the Businessmen's Advisory Group. Light B. Yost, Director of Field Operations for the General Motors Corporation, is Secretary of the Group.

EDITORIAL

Turnpikes Bring New Responsibilities

The toll turnpikes with their advance feasibility studies and revenue bond financing, and their design and construction under specialized consultants, usually have represented a break with local roadbuilding concepts. This has been a healthy thing.

The West Virginia Turnpike, the grading of which is described in this issue, is in keeping with the new turnpike tradition. It is being built with great speed, under pressure of public need and of the desire to get toll collections started. And it is being built well, although at necessarily high cost.

This road also is generating its full quota of controversy. The state newspapers have lined up for or against this boldly conceived project, some insisting that the West Virginia Turnpike should be just as wide and long as the Pennsylvania Turnpike. Unfortunately, the initial West Virginia Turnpike project had to be cut back to two lanes (plus uphill truck lanes) due to unexpectedly high construction cost under available financing. Dualization will come as traffic develops and is provided for in planning.

The usual doubters say the road will not be successful. It will definitely pay off, the assured national traffic growth being in its favor along with the great ability of a modern highway on new direct location to generate its own traffic and business developments.

● Our concern isn't over traffic patronage, but over the long-range outlook for proper administrative management of this road. By this we mean maintenance and traffic control, and more broadly the planning of future dualization, extension and connecting links so that the road's full potential worth can be realized to West Virginia's economic advantage.

The fact is that this fine new highway is being born into a state which has some of the Nation's most run-down and obsolete roads and one of the worst past records for political neglect and mismanagement of highway affairs. Will the sound legal and administrative machinery initially achieved for this road be allowed to continue? In buying themselves a fancy new turnpike the people of West Virginia and their legislature have focused anew on the imperative need to put their highway affairs on a healthier basis for the long pull.

Presently things are looking up. Besides having progressive citizens on the turnpike commission and an outstanding leader in Ray Cavendish, the turnpike commission's executive director, the state also is fortunate in having a vigorous and capable leader in state road commissioner Griffith and a number of able career engineers in the road department. A legislative committee has initiated a statewide engineering study of highway needs. The present under-staffed road department is being analyzed for an overhaul by a management consultant. And state road finances are being given a sweeping study as a preliminary to seking new funds.

Meantime this writer recently observed such poor and dangerous maintenance conditions, and in one instance such inferior conduct of a state road widening and resurfacing project, that this page of comment came to mind.

No state has more to gain than West Virginia by making bold and decisive use at this time of the new wealth creating tool of highway design. The present winding, steep mountain roads such as U.S. 60 can be partially modernized to improve their capacity, but the real opportunity is to play for higher stakes by building high-average-speed roads to inter-regional standards. Admittedly this is costly in rugged terrain. But big too are the economic rewards that will follow the creation of new East-West and North-South trucking and touring axes through this strategically located area.

● Coming back to the present turnpike, it will require an exceptional traffic control program. The intermingling of trucks and autos on a 2 or 3-lane mountain grade, traversing rainy, foggy mountain highlands, will set up basic hazards regardless of traffic density. Experience in operating other toll roads, with the latest multiple car pile-ups fresh in mind, serves notice that good construction is not the end but only the beginning of the management problem.

Tough policing of speed is emerging as a key factor in all heavy arterial traffic control. Steady hourly mileage rather than high speed should be the advantage sold to the public.

It appears no longer necessary or advisable to sell the motoring public on the usage of a turnpike on the basis of virtually unlimited speed. Uncontrolled high speed and fatalities go hand in hand. Every recent statistic shows that practically every accident is directly the result of driver or mechanical failure or both. Every reasonable safety feature is incorporated in the building of the modern turnpike. The most direct step toward greater highway safety lies in more definitely controlled and regulated speed. The need for strict traffic control, through policing and driver education, on the West Virginia Turnpike appears paramount.

West Virginia is getting a new turnpike—and its people and their present and future legislatures a new set of responsibilities.

IT COSTS LESS TO BUILD GOOD ROADS THAN TO HAVE POOR ROADS

★ Weaver Construction Company's repair equipment is seen strung along the outer west-bound lane. Patching is done one lane at a time under elaborate traffic safeguards

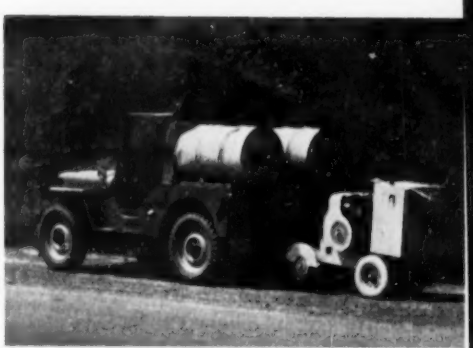
How Granddady Turnpike Pavement is Kept in Good Repair

Pavement patching on parts of the original 160-mile Pennsylvania Turnpike is being performed by contract. This work supplements alert staff maintenance which keeps this prewar dual concrete pavement in excellent condition under very heavy truck traffic.

THE original 160-mile central section of the Pennsylvania Turnpike was opened to traffic in 1940. The pavement design consists of 9 inch thick reinforced concrete 24 feet wide for each of the dual roadways. The pavement was placed on natural subgrade. From the day of its opening, the turnpike traffic exceeded all expectations. The road was a lifeline for hauling war goods.

In the postwar years its traffic has climbed steadily, until in 1952 more than eleven million vehicles or 30,000 daily average passed over the system, including 2,209,915 trucks or 6,000 per day, most of which were in the higher axle load bracket.

The spotlight has been turned on this famed section of pavement because of the controversies over the selection of toll road pavements elsewhere. The satisfactory performance of this pavement resulted in the selection of concrete for the eastern and western extensions of the Pennsylvania Turnpike, completed in 1950 and 1951, and for the 33-mile Delaware River extension now in the grading stage. The pavement design for the eastern and western extensions consists of 9-in. and the Delaware River extension 10-in. uniform



★ A portable power saw first makes cut for patch area

★ Next wagon drill widens saw cut on inner side before break-out of old concrete

★ Pavement partially cut through is broken out with a rammer, after which a small shovel digs out the broken concrete. This type of loading unit is needed because of the reinforcing mesh enountered

★ Concrete is centrally batched and delivered by truck mixer

thickness reinforced concrete on a 6-in. granular blanket, with a subgrade compacted to 100 per cent (standard AASHO) in the upper layers.

Pictured and described here are methods used during the 1953 summer by Weaver Construction Company, one of the two contractors on the 1953 work. The job consisted of replacement of approximately 10,000 sq. yd. of pavement on a 34-mile contract repair section beginning at Irwin, the west end of the original turnpike, and extending eastward to Laurel Hill. This was one of two contracts this year for pavement repairs.

This 34-mile repair section included 136 lane-miles of concrete pavement and the replacement represented slightly over one per cent of the total pavement with about 97% of it in the outer lane. (The outer lane is the constant driving lane as per Turnpike Rules and Motor Code Regulations in Pennsylvania on dual highway systems; the inside lane is used only for passing purposes.) Much of the patching was concentrated at points where pumping had developed and accelerated deterioration had occurred at joints due to a combination of poor drainage and inferior subgrade soil.

Repair Methods

The procedure used by this contractor is described as follows:

Taking pavement areas marked by the engineers, the contractor first makes a cut about 2 in. deep with a power saw of the single blade type. A wagon drill powered from a truck-mounted compressor is used with a concrete chipping tool to cut a 2-in.-wide groove along the inner side of the saw cut. This operation is carefully performed so as not to chip the outer side of the saw cut, its purpose being to insure a neater edge.

With the replacement area thus outlined, the concrete is broken up with a hydraulic rammer, and re-

★ Heavy traffic such as is pictured here is a constant procession on the Pennsylvania Turnpike. Current traffic includes 6,000 or more heavy trucks daily.

BIGGEST FORD TRUCK EVER BUILT—New F-900 Big Job is rated for 27,000 lbs. G.V.W. As a tractor with semi-trailer it wheels a 55,000-lb. G.C.W. at a calculated top speed of over 48 mph.

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★ All concrete replacement is done behind steel road forms, and mechanically finished and paper-cured in accordance with new pavement standards

moved by a ⅜ or ½ yd. power shovel loading into trucks for disposal. The subgrade is then undercut to a depth of 6 in. below the bottom of the slab, using a front-end loader bucket. This undercut is carried to the outer shoulder edge.

It should be noted that nearly all sections removed take in some pavement width on each side of a joint. Wire mesh reinforcement is ripped away in the process, and protruding wire ends trimmed back.

At this point a jackhammer operator moves in, with a mobile compressor unit, and cuts horizontal holes in the exposed transverse slab edges into which 1 in. dia. by 2 ft. long load transfer dowels are grouted. The undercut is backfilled to subgrade elevation with crushed slag and rolled with a 10-ton 3-wheel roller, this material also extending through the shoulder for drainage.

Ready-mixed concrete is placed behind steel road forms and finished with a 12-ft. mechanical finisher followed by a lute and other hand manipulation, which however is kept to an absolute minimum. Wire mesh is employed. An 8-sack mix is specified for early strength and following paper cure the pavement is opened to traffic in 3 to 4 days.

Transverse joints are reconstructed at their original positions, using steel plates and dowels, care being taken to line up the joint with the joint in the opposite lane.

Equipment used by Weaver Construction Co. for the foregoing procedure has included a Tri-Line saw, a Chicago Pneumatic wagon drill with a Chicago Pneumatic 460 cfm. compressor on a Dodge truck, an Ottawa Hydra-rammer for concrete breaking, a Wayne shovel for slab removal, several International TD4 tractors with Bucyrus-Erie dozers for cleanup, a Hough loader for undercutting subgrade and shoulder, A LeRoi Tractair for air supply in cutting dowel holes, a Hercules 10-ton roller, Blaw-Knox road forms, a Jaeger-Lakewood finisher, Sisalkraft curing paper, various pick-up trucks, a supply of traffic warning signs.

Contract 163—Weaver Coal and Construction Co.

(West of Laurel Hill Tunnel)

5,916 Sq. Yd.	Remove Existing Pavement @ $2.00	$ 11,832.00
5,916 Sq. Yd.	9-in. Reinf. P.C. Concrete Pvmt. @ $10.85	64,188.60
2,000 Cu. Yd.	Excavation @ $2.80	5,600.00
2,298 Tons	Selected Subgrade material @ $4.10	9,421.80
720 Cu. Yd.	Borrow @ $2.75	1,980.00
13,010 Lin. Ft.	Underdrain @ $2.65	34,476.50
	TOTAL	$127,498.90

Contract 164—New Enterprise Stone & Lime Company

(East of Laurel Hill Tunnel)

9,900 Sq. Yd.	Remove Existing Pavement @ $1.90	$ 18,810.00
8,900 Sq. Yd.	9-in. Reinf. P.C.C. Pvmt. @ $8.00	71,200.00
2,965 Cu. Yd.	Excavation @ $2.40	7,116.00
3,720 Tons	Selected Subgrade Material @ $3.20	11,904.00
920 Cu. Yd.	Borrow @ $2.85	2,622.00
17,939 Lin. Ft.	6-in. Tile underdrain @ $2.50	44,847.50
1,000 Sq. Yd.	9-in. Reinf. P.C.C. Pvmt. patches of less than 19 sq. yd. @ $9.00	9,000.00
	TOTAL	$165,499.50

Traffic jams costing New York billion yearly

The citizens of New York are paying $1,082,200,000 annually for their traffic congestion, according to a thorough and clearly presented report compiled by the Citizens Traffic Safety Board of the city. Described as the first definitive economic study of the city's traffic congestion in 29 years, the data were divided into fifteen categories.

Nine direct items accounting for $973,000,000 of the loss:

- Extra motor fuel for cars and trucks, $75,000,000.
- Increased taxi charges due to delays, $57,000.000.
- Wages, mostly industrial, lost in traffic delays, $350,000,000.
- Rapid depreciation of vehicles, $175,000,000.
- Excessive vehicle repairs and maintenance (not counting accident damage), $75,000,000.
- Loss to entertainment business from lack of parking, $30,000,000.
- Retail sales loss, $100,000,000.
- Loss to city in tax revenues from suburban expansion and unrealized population gain, $11,700,000.
- Loss from unrealized new construction, $100,000,000.

About 50 per cent of the economic loss is centered in the Borough of Manhattan.

New York City's ratio of motor car ownership per unit of population is lower than the national average, and markedly lower than the figures for such spread-out and fast growing motorized cities as Los Angeles.

The report, which was issued by board president Percy C. Magnus representing business and civic interests, also noted indirect losses due to congestion. These include $30,000,000 for excessive insurance premiums due to the high accident rate; $26,500,000 for economic losses from traffic accidents in excess of the national average; lowered efficiency of city services, $10,000,000; and miscellaneous, $10,-000,000. Time losses of top-salaried business executives is set at $18,750,-000 annually from traffic delays.

In commenting on this report a New York Times editorial urged greater use of the one-way traffic principle for north-south streets in Manhattan, but had little definite to suggest otherwise.

A more tangible idea recently proposed by New York City's construction coordinator Robert Moses is the construction of large parking facilities by the city for private business operation, on a lease basis.

no other grader offers you this

UNBEATABLE COMBINATION

all-wheel drive

wakes up the front wheels

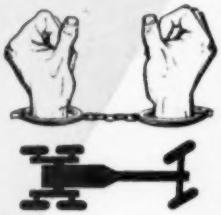
The front end of the ordinary motor grader is lazy, dead weight, contributing nothing to traction.

On the Austin-Western Power Grader, every pound rides on a driving wheel, contributing 100 per cent to traction.

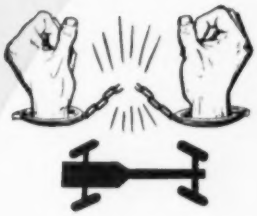
all-wheel steer

frees the rear wheels

Non-steerable rear wheels slow-down all operations, make them more difficult.

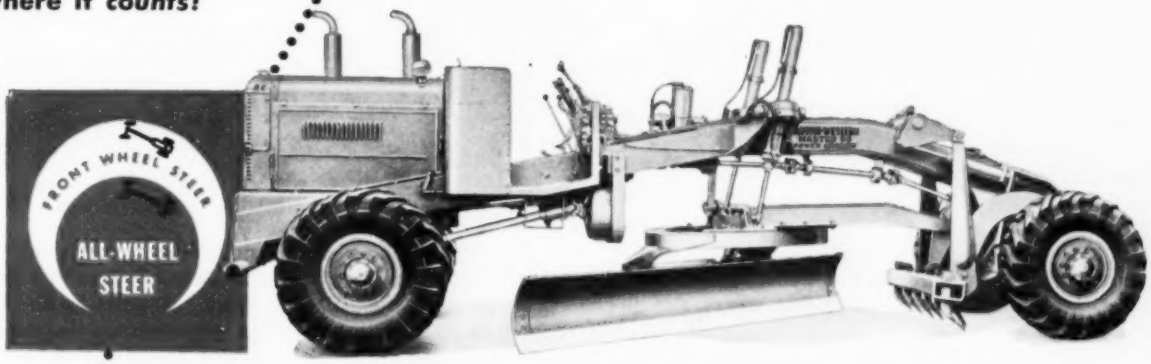


Steerable rear wheels speed up every job, make it easy to do things impossible for other graders.



Twice the maneuverability

30% more POWER at the blade—more power where it *counts!*



No wonder . . . Austin-Western "88-H," "99-H" and Master "99" Power Graders, with their finger-tip hydraulic control and unequaled stamina, plus exclusive All-Wheel Drive and All-Wheel Steer, outpull, outmaneuver and just naturally outperform all others.

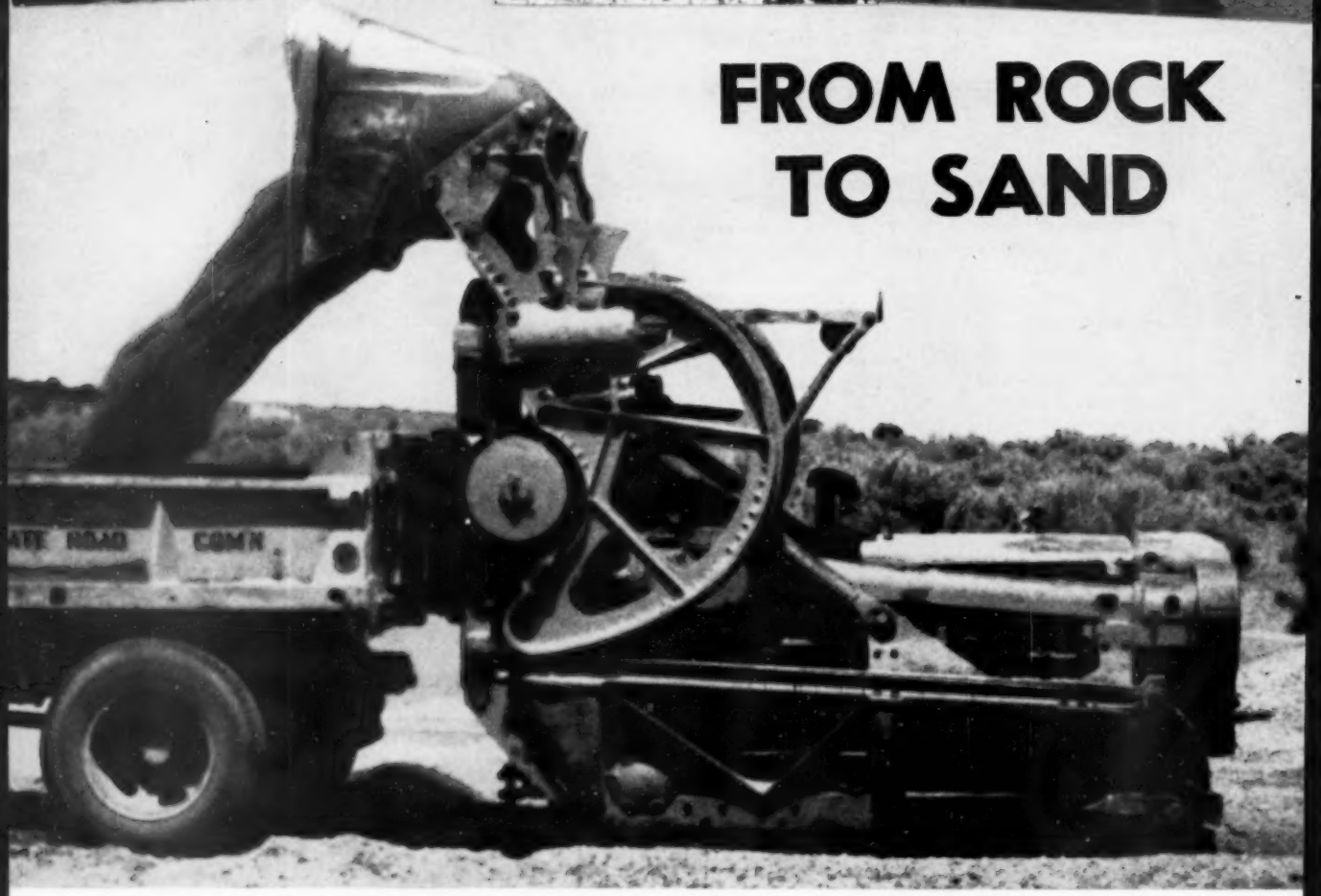
Austin-Western

Power Graders · Motor Sweepers
Road Rollers · Hydraulic Cranes

BALDWIN BLH LIMA HAMILTON
Construction Equipment Division

Manufactured by
AUSTIN-WESTERN COMPANY
Subsidiary of Baldwin-Lima-Hamilton Corporation
AURORA, ILLINOIS, U.S.A.

FROM ROCK TO SAND



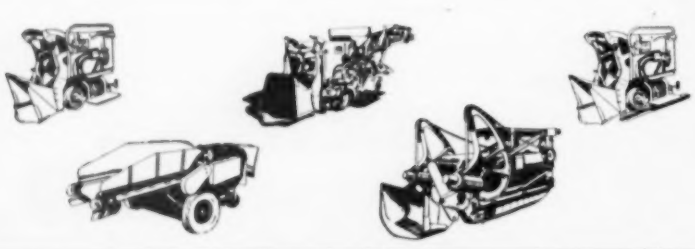
Heavy loading jobs require Eimco machines designed and built for heavy work. Eimcos were built to load rock and stay on the heavy jobs where other equipment fails.

Rock digging and loading in blocky, abrasive ores underground or on the surface at the rate of three to four yards per minute is average. They run forward to dig and load — backward to discharge overhead.

Every job can use one or more Eimcos for stockpile loading, bulldozing, digging in narrow places, loading trucks, etc. They're ideal for highway clean-up jobs. They dig and load economically in rock, sand, gravel, sticky clays and other materials and discharge the bucket clean into trucks or railroad cars.

Write for information.

EIMCO



THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 10, UTAH, U. S. A.

BRANCH SALES AND SERVICE OFFICES:

NEW YORK, 51-52 SOUTH STREET • CHICAGO, 3319 SOUTH WALLACE STREET
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EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIF., 637 CEDAR STREET
KELLOGG, IDAHO, 307 DIVISION ST. • LONDON W. 1, ENGLAND, 190 PICCADILLY

IN FRANCE, SOCIETE EIMCO, PARIS, FRANCE
IN ENGLAND: EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
IN ITALY: EIMCO ITALIA, S.P.A., MILAN, ITALY

Only ADAMS Motor Graders give you all these features

• Never before have so many important work-producing, money-saving features been incorporated in one motor grader—*and you get them all only in Adams improved heavy-duty models.*

A typical owner comment comes from C. H. Lawson, president of C. H. Lawson, Inc., contractors of Williamsburg, Va., who says of his new 100 hp. Adams, pictured above, "This is the best motor grader I have ever owned. I like its speed and traction, and it has plenty of power to handle a full blade. Also I like its ability to back up fast."

Ask your local Adams dealer to demonstrate one of these high-performing, cost-cutting motor graders—*on one of your own jobs.*

J. D. ADAMS MANUFACTURING CO. • INDIANAPOLIS, IND.

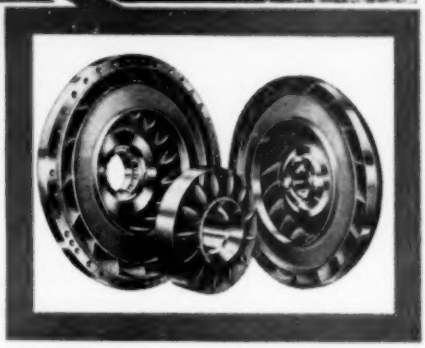
Make your next motor grader an

ADAMS

...Smoother power!
...Better performance!

with the NEW TORQUE CONVERTER

PAYLOADER®



The big, husky 1½ HM "PAYLOADER", the leader in the field, now further establishes its superiority with the extra advantages of a Torque Converter drive. Gives you extra power for tough going, smoother power at all times, more lugging power, more engine efficiency, for faster, lower cost material handling.

Combined with the 4 speed, full reversing transmission, the Torque Converter provides an unlimited range of automatically selected speeds to meet the load and operating conditions. Parts breakage and maintenance are less because shock loads are absorbed.

More than a year of field testing "on the job" gives you proven performance. It's the finest tractor-shovel available — and we'll prove it! Ask your "PAYLOADER" Distributor for a demonstration or write The Frank G. Hough Co., 768 Sunnyside Ave., Libertyville, Ill.

TORQUE CONVERTER DRIVE

More Efficiency — Engine operates at most efficient speeds — no laboring or stalling

Lower Maintenance — Oil cushion absorbs load shocks — protects vital parts

Easier Operation — Eliminates much gear-shifting and "clutching"

Greater Output — Operates at highest speed in relation to load

PAYLOADER®

THE FRANK G. HOUGH CO. • Since 1920

Are your maintenance costs

Out of joint?

Joint-sealing every year costs too much money . . . cuts deep into maintenance budgets. Put *one* application of FLINTSEAL* in your concrete pavement joints . . . *and then forget those joints for years!*

Unlike the old types of bituminous fillers which crack and leak in cold and flow and smear in heat, rubber-asphalt Flintseal stays put . . . remains extensible and compressible through expansion and contraction of the pavement slabs.

Seals out water—*positively* . . . yet is flexible and resilient . . . bonds to joint walls perfectly!

So don't take chances! Look at savings over the years by using Flintseal. Write for complete data. *Reg. U. S. Pat. Off.

THE FLINTKOTE COMPANY, *Industrial Products Division*, 30 Rockefeller Plaza, New York 20, N.Y.—55th & Alameda Sts., Los Angeles 54, Calif.

In Toronto, Ontario: THE FLINTKOTE COMPANY OF CANADA, LTD.

In London, England: Industrial Asphalts Company, Ltd.

For airports: "Flintseal JFR" (a hot-poured jet fuel resistant type) is used to seal joints in airfield runways, taxiways, aprons and hangar floors.

Note: For those who prefer a cold-applied sealer, ask for information.

Specialized Experience—
Over 50 Years At Your Service—
by phone, mail or personal call... no obligation.

Flintseal

HOT-POURED JOINT-SEALING COMPOUND

Bulldozing — Hydraulic torque converter lets Allis-Chalmers HD-20 take full advantage of available horsepower, roll bigger loads, tackle tougher dozing jobs. With full control at the throttle, operator can work safely and efficiently, regardless of terrain.

AN ALLIS-CHALMERS REPORT

How hydraulic torque converter drive improves big tractor performance — increases job output

With a two-range transmission and hydraulic torque converter, the Allis-Chalmers HD-20 is the only crawler tractor that is capable of exerting maximum drawbar pull *at all times* . . . under all load and terrain conditions . . . without gear-shift guesswork.

Whatever the job, the operator need merely make contact with the load and then open the throttle. As the load requirements change, the hydraulic torque converter *automatically* matches the conditions with exactly the right combination of speed and pull.

This eliminates most shifting . . . leads to far more work done in a continuous work cycle . . . far longer equipment life.

• • •

Hydraulic torque converter drive, exclusive as standard equipment with Allis-Chalmers, is just one of many reasons why the HD-20 assures you higher output with less upkeep. Your nearby Allis-Chalmers dealer invites you to get the full story . . . and to see it in action.

WEIGHT — 41,000 LB. • 175 NET HP. AT FLYWHEEL

ALLIS-CHALMERS
TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

Pulling — Hydraulic torque converter drive actually multiplies torque up to four and one-half times . . . develops tremendous drawbar pull to start the load smoothly . . . and automatically accelerates to the highest speed that conditions permit, in either high or low range.

Pushing — Operator just makes contact, then opens the throttle and relaxes. The HD-20 automatically matches speed to that of pushed equipment, maintains steady contact while loading, sends load off to the fill at higher speed.

Digging and Loading — With the HD-20G, the operator crowds surely and steadily, using only throttle and bucket levers. With full horsepower always available even at creeping speed, he can work effectively in mud, on hillsides or edges of banks.

Meetings Ahead

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS—39th Annual Meeting, William Penn Hotel, Pittsburgh, Pa.; November 10-13.

CHAMBER OF COMMERCE OF THE UNITED STATES—National Highway Conference, Washington, D. C.; December 8-9.

AMERICAN ROAD BUILDERS ASSOCIATION —Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.; January 11-13, 1954.

CONSTRUCTION INDUSTRY MFRS. ASSOCIATION — Annual Board Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.; January 11, 1954.

HIGHWAY RESEARCH BOARD — Annual Meeting, Washington, D. C.; January 12-15, 1954.

ASSOCIATED EQUIPMENT DISTRIBUTORS —Annual Meeting, Waldorf-Astoria Hotel, New York City; January 31-February 2, 1954.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS—Annual Meeting, Kentucky Hotel, Louisville, Ky.; February 1-3, 1954.

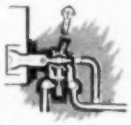
WHITE HOUSE CONFERENCE ON TRAFFIC SAFETY—Departmental Auditorium, Washington, D. C.; February 17-19, 1954.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC. — Annual Meeting, Statler and Biltmore Hotels, Los Angeles, Calif.; February 26-March 3, 1954.

Highway "slaughter" is editorial topic

The problem of highway traffic accidents was given the spotlight by Raymond Moley in a recent issue of "Newsweek." After dwelling on the hazards that tended to spoil his personal vacation trip by car, he enumerated accident statistics familiar to highway leaders. These figures he personalized by showing that more people are killed per year in motor traffic in the U. S. than the deaths in the entire Korean war.

Of special interest to highway leaders is the stand that this observer took on the causes of the death toll. He blames it largely on speed—the tendency of motorists to go faster than the posted speed, and the laxity of policing and enforcement. "Better highways, more education, safer cars, lower speed limits, and stricter laws will help," he said, "but there is no substitute for a good cop."



"BAKER FINGERTIP CONTROL is the best I ever had my hands on," says Allen Knight, Bulldozer Operator of Indianapolis, Ind., "and I've run 'em all. I can feel where the blade is . . . I get better control of my work."

Talk to operators of Baker-equipped A-C Tractors . . . you'll find they prefer the easy, natural operation of *Baker* Fingertip Control. With the exclusive Baker control-valve system, they can *hold* the blade in any position—without settle or "suck in." Result is *better work*—done with *less fatigue.*

Also important for control sensitivity and accurate blade response is Baker-designed *Direct-Linkage.*

With excess linkage *eliminated,* Baker Blades are *rigid* and *rugged*—with *fewer moving parts that work better and last longer.*

Your Baker, A-C Dealer will be glad to demonstrate!

The BAKER MANUFACTURING COMPANY • SPRINGFIELD, ILLINOIS

Salt Stabilization for Low Cost Roads

Methods used on a demonstration road in Illinois this year are here outlined, along with a discussion of general advantages and recommended procedure for this type of road.

MUCH has been heard about the binding and stabilizing qualities of ordinary salt, when added to well graded road gravel or crushed aggregate. Highway officials in Northern Illinois had a chance to witness the methods and see some of the immediate results recently, when a demonstration was staged by county and local road men near Geneva.

The road selected for the demonstration is a lightly traveled road on the line between Kane and DeKalb counties. These counties cooperated, along with Winfield, Geneva and St. Charles townships adjacent. Salt was furnished by Morton Salt Company, along with technical suggestions. Equipment and operators were supplied by the townships, and a Seaman pulverizer and Century spreader were supplied by local equipment distributors, with Seaman engineers also contributing advice on procedure.

The 2.7 miles of road selected to be improved had been lightly graveled but needed re-cross-sectioning and new base material. The first steps were to scarify and recrown the road and haul and spread sufficient new material for 18 ft. width of 4 in. compacted thickness roadbed. Pit gravel graded to ¾ in. maximum was used from a nearby commercial pit, this material having sufficient binder to secure good mechanical stabilization. Material was spread from the tailgate and laid out with an Austin-Western motor grader.

Processing was then performed on work sections about 1,000 ft. long. Salt was applied at a rate based on application of 7,200 lb. per mile over an 18 ft. width, the spreading and mixing being done on a 9 ft. lane. Water was added where necessary ahead of salt application, and further sprinkling was done during and following the mixing. No moisture control was used, however, other than a visual check to see that the gravel was sufficiently moist to compact well.

The grader operator made light blading passes to skim the uneven spots and produce a smooth riding surface.

Mixing was performed with a Seaman mixer, which usually made a round trip over each lane, making additional passes only where low or soft spots developed during initial compaction necessitating the addition of more gravel. Compaction followed closely, using a wobble wheel pneumatic tired roller, drawn by a Hough loader.

The direct cost of this improvement was calculated at about $100 per mile including normal equipment rental and labor, plus gravel and salt. Completed in April, 1953, the road has stood up well through the present summer.

Salt Effects Discussed

Morton Salt Company highway engineers define a salt-stabilized road as an all-season, low-cost road with a wearing surface of graded aggregate. It can be constructed with such materials as gravel or crushed limestone (with the over-1-in. removed), slag, sand or natural soil binders, the material being properly proportioned and bound together and maintained in its maximum cohesive state by salt action.

The effect of rock salt on soil mixtures used for road surfaces, according to Morton, arises from the properties it imparts to properly proportioned soil mixtures through water retention, crystallization, increase in surface tension and physical chemical changes in the clay components. Because rock salt brine has a lower vapor pressure than water, the evaporation of moisture from soil mixtures wetted with rock salt brine is slower than from similar mixtures moistened with water. Rock salt is a stabilized mixture; therefore it acts to conserve its water content. This conservation is most apparent during compaction of the stabilized mat with which rock salt has been mixed. The plasticity of the clay components is maintained over a longer time, which prolongs the period during which compaction is taking place, permit-

★ New gravel was kept well dampened and salt was applied at a predetermined rate with a modern spreader. Uniform application essential for best results

★ A mixer pass being made over the freshly applied salt. This type mixer blends the lift thoroughly for maximum stability. Pneumatic roller passes were made immediately following the mixing, and in between skimming passes of the motor grader

ting compression into a denser mass with thinner and consequently stronger and more lasting binding films than would otherwise be secured.

As the partially dried road continues to lose water, the salt brine in the surface becomes concentrated to the saturation point and deposits fine crystals, forming a dense hard crust of salt and aggregate which appreciably retards further evaporation. Crystallization of salt brine within the pores of the compacted mass, as evaporation slowly proceeds, contributes to its strength and stability. This filling of the voids minimizes the contraction which commonly accompanies loss of moisture, and thus reduces shrinkage cracking.

Prevents Clay Shrinkage

Continuing the salt company's discussion, the importance of diminution of shrinkage in this way will be realized when it is considered that any shrinkage of the clay bond causes it to crack or to pull away from the coarse aggregate. This allows the latter to become dislodged and ravel under traffic. Admixture of approximately one ton of salt per mile per inch of depth for 20 ft. width is recommended; the aggregate, soil and salt per mile per inch of depth for 20 ft. width is recommended; the aggregate, soil and salt must be uniformly mixed to obtain firmness and density under compaction, in order to retain the moisture so necessary to prevent raveling and potholing.

The kind of aggregates used are not of prime importance, provided they consist of reasonably sound, tough, durable particles which will withstand wearing conditions. If sufficient soil binder is not present, clay from shoulders, ditches or local clay banks can be added.

The need for the proper amount of water is important. Materials will not stabilize until they have been wetted. Water is to be added to make a brine and care should be taken that materials do not become sloppy. It has been found that any material that can be moistened, picked up in the hand, and when the fist is clenched and opened the material retains its

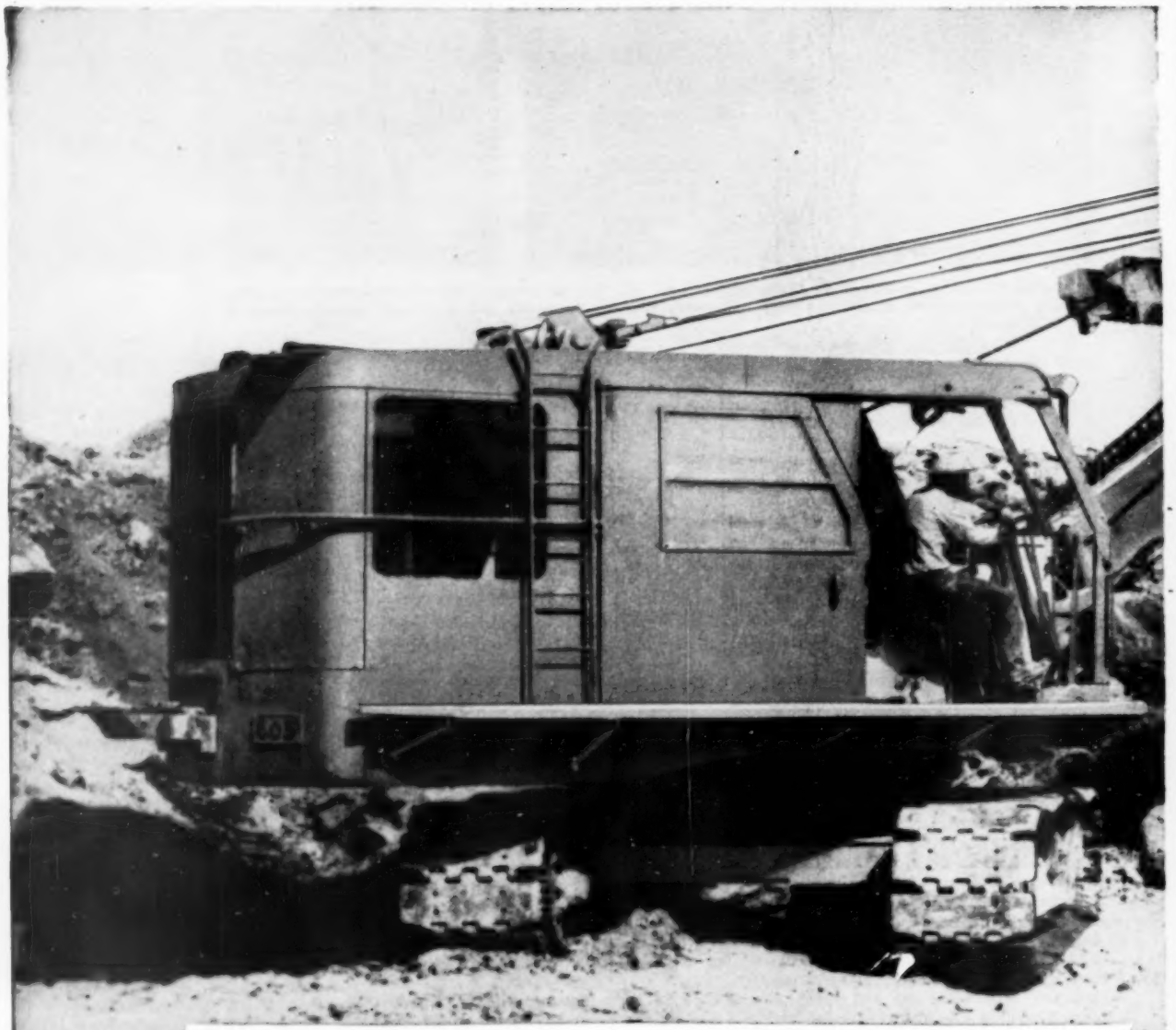
(Continued on page 60)

HOW TO STABILIZE WITH ROCK SALT

(As recommended by Seaman Motors, Inc.)

- *Rock salt, blended with well-graded gravel or crushed aggregate, is successfully incorporated as a weather-resistant binder and stabilizer.*
- *Mixed in correct amount with the soil, it also considerably lowers the temperature at which injurious frost action will occur, and also abates its damaging effect.*
- *When mixed with well-graded aggregates at optimum moisture content, the salts form a solution which so lubricates the mass as to improve its workability. Better density and water-tightness of the mix result.*
- *The increased workability also has its advantages in that pneumatic rolling, after the mixing, gives the surface a tight, resistant, glazed finish. Such finish helps to anchor the coarse aggregates and to maintain better freedom from the dust nuisance.*
- *After compaction, the salts are said gradually to recrystallize and to form a thin coating over the aggregate particles, both the large and the small. This coating is believed to retard the movement of moisture throughout the mass and thus stabilize it against becoming too wet or too dry.*
- *Stabilization with rock salt is a very simple operation. The process may apply equally well to new work or to the reconstruction of old surfaces.*
- *The selected aggregates for stabilizing should be well graded from coarse to fine. If the subsoil is of proper type, it may be utilized to supply the amount of fines needed.*
- *When mixed with a Seaman, the maximum diameter of aggregates may safely be of a size slightly less than one half the thickness of mat being stabilized.*

★ The motor grader is shown making a final skim over the stabilized salt-gravel surface



MEASURE OUTPUT by "KOEHRING WORK CAPACITY"

With Koehring excavators and cranes you gain an important production advantage in extra work capacity. There are some very simple ways to check this. Take lifting capacities, for instance. The machine with the heaviest lift capacity not only picks up larger crane loads — it also has more stability and power to increase shovel, dragline and clamshell output. Be sure to check lift ratings, and other clear-cut measurements of "KOEHRING WORK CAPACITY" before you buy any excavator or crane. Your Koehring distributor has important figures to show you. See him soon.

K331

lift capacities up to 79½ TONS . . . ½ to 2½ YARDS dipper capacities

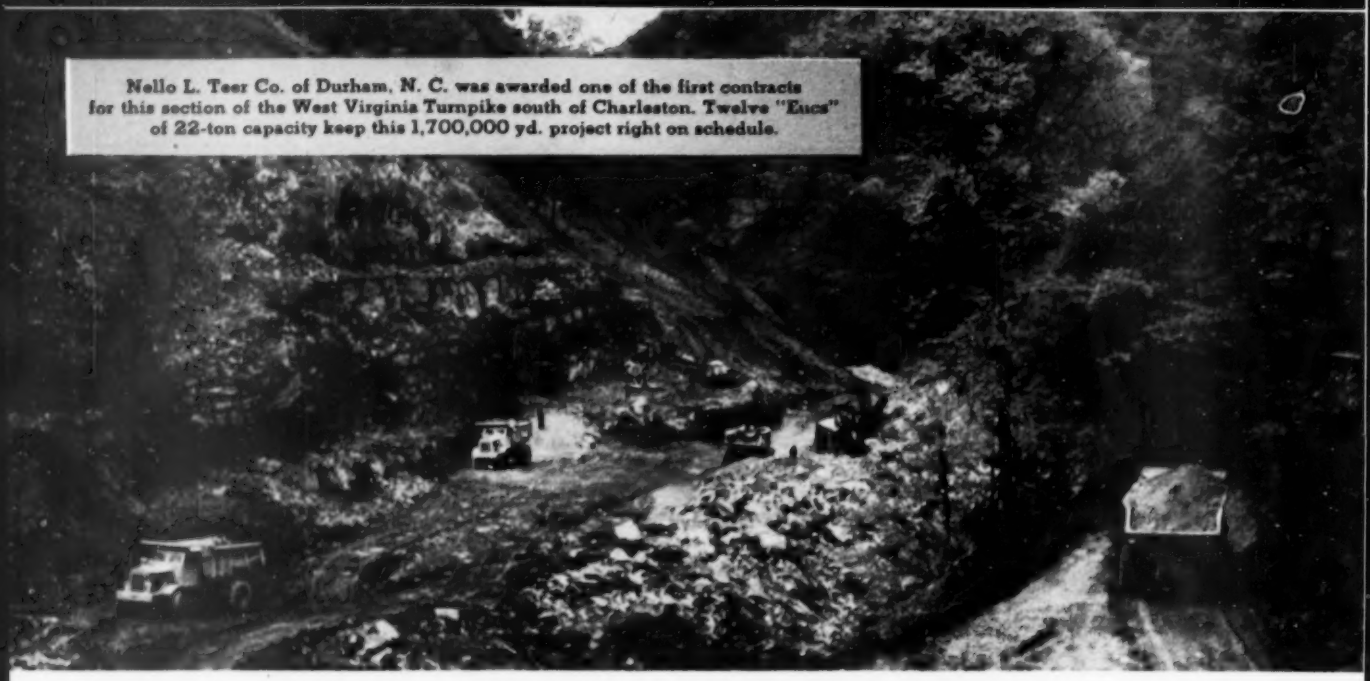
BIG-PRODUCTION TEAM — Loading out big-chunk rock, this Koehring 1½-yard shovel is teamed up with Koehring 6-yard Dumptors.® Fast-spotting Dumptors move in close, keep shovel swing short. Square 8 x 8-ft. body permits loading over side or end. No-turn shuttle hauling and instant gravity-dump speed haul cycles.

KOEHRING Company

MILWAUKEE 16, WISCONSIN

Subsidiaries: Parsons • Kwik-Mix • Johnson

191 "Eucs" carving out a Turnpike in West Virginia



Nello L. Teer Co. of Durham, N. C. was awarded one of the first contracts for this section of the West Virginia Turnpike south of Charleston. Twelve "Eucs" of 22-ton capacity keep this 1,700,000 yd. project right on schedule.

BUILDING the 88-mile two-lane West Virginia Turnpike is a big, mighty tough job . . . over 25 million cubic yards of excavation, mostly rock. Some of the contract sections will run up to 600,000 cu. yds. of excavation per mile due to the rugged terrain which requires deep cuts and fills as high as 120 feet.

The contractors on this rush job—scheduled for completion June 1, 1954—have been almost unanimous in their selection of Euclid equipment for this heavy grading. They know from experience that they can depend on "Eucs" to move more loads per hour at lowest cost . . . they know that "Eucs" have plenty of power to move big loads up steep grades and over the most difficult haul roads . . . and they know, too, that "Eucs" are tops for job availability when it comes to handling tough yardage.

Every day 191 "Eucs" are proving that the choice of these contractors was the right one. Your Euclid Distributor will be glad to show you why "Eucs" are <u>your</u> best bet for more production and more profit.

On this section "Eucs" are loaded with heavy rock and shale by shovels of 2½ yd. capacity.

It takes plenty of power to haul 22-ton loads on grades that exceed 20% on many of these jobs!

The EUCLID ROAD MACHINERY Co., Cleveland 17, Ohio

EUCLID (GREAT BRITAIN) LTD. • GLASGOW, SCOTLAND

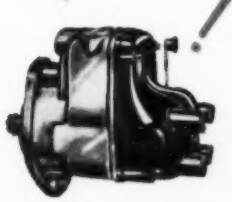
Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

BEST in the Long Run!

AMERICAN BOSCH MAGNETOS

Here's Trouble-free **SPARK IGNITION** *for Your* **WISCONSIN V-Engine USERS!**



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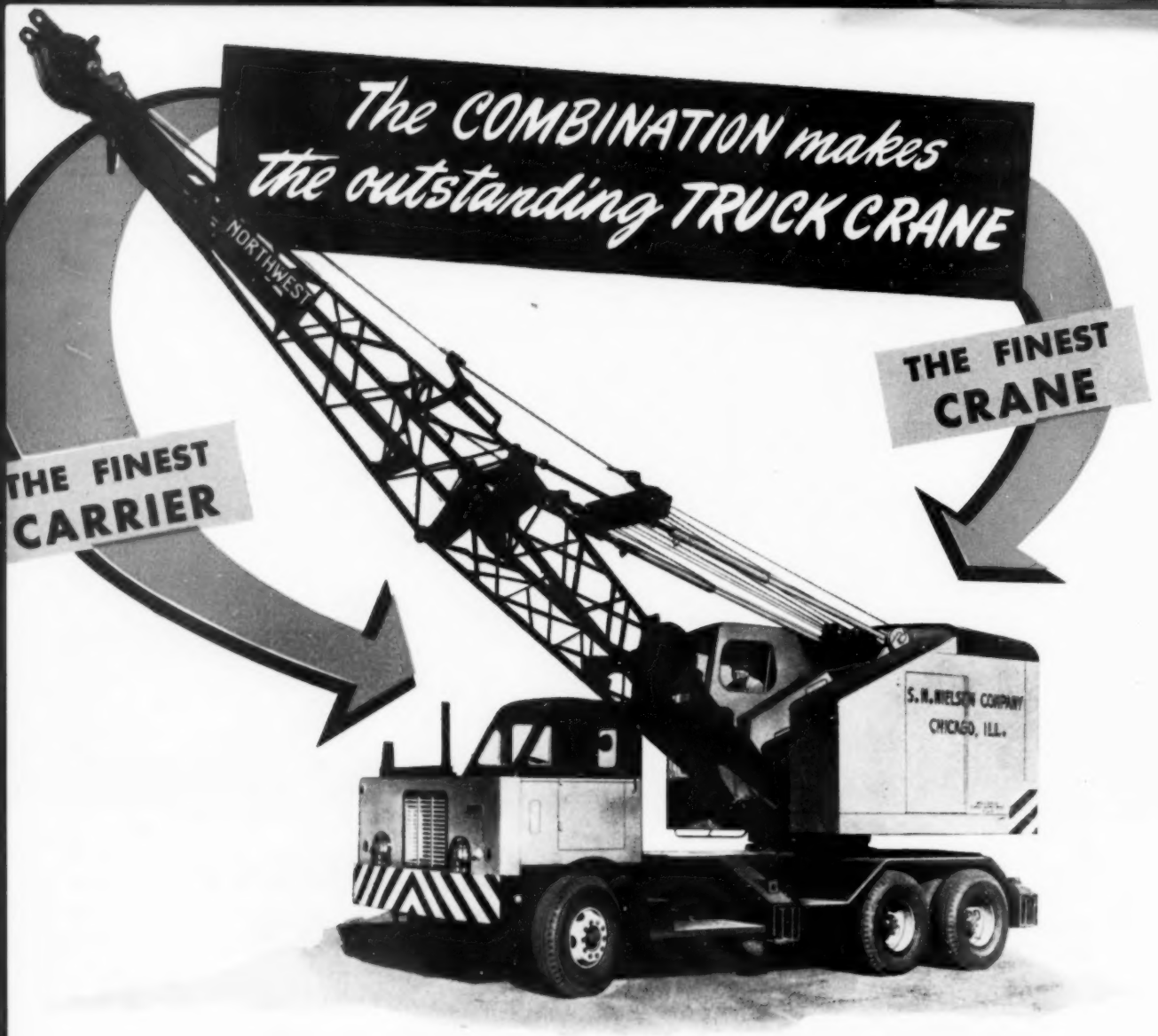

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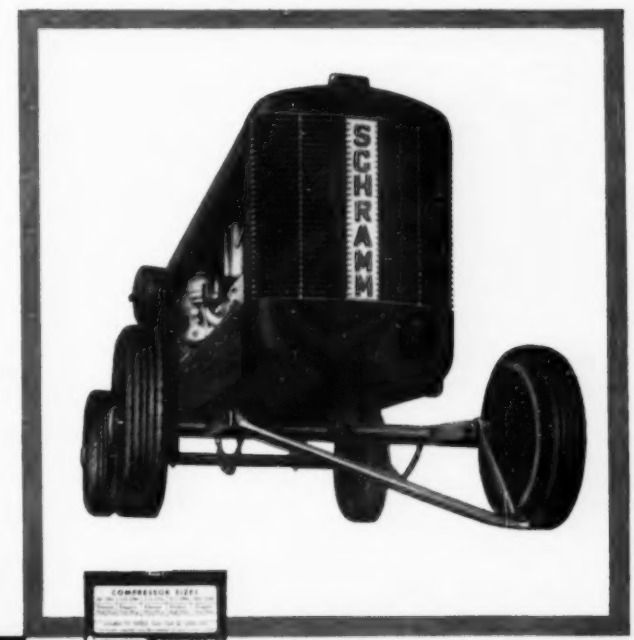

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Western Highway Officials Review Problems

Santa Fe meeting delegates told of need for new federal highway legislation. Conference sessions covered score of topics ranging from public relations to compaction specifications.

THE monumental highway need was the overshadowing topic at the annual meeting of the Western Association of State Highway Officials, held October 7-9 at Santa Fe. As with all road official gatherings these days, first place on the program was given to the need for more funds, new legislation and related topics. Some 230 delegates from 12 western states and Alaska attended.

Congressman John J. Dempsey (N.M.) told the general session of the need for stepping up the national tempo of roadbuilding, now "fifteen years behind" and paced currently by $575 million annual federal highway aid. Key to his thinking is the fact that the condition of the nation's roads makes them the weakest link in our National defense.

Keynoter of the convention was 1953 president Mark U. Watrous, chief highway engineer of Colorado, who stressed the public relations task confronting highway leaders. Speaking on the subject of "Too Much Engineering," he said that highway departments are entitled to only as much public confidence and respect as their record merits, at the same time saying that "the time is over when we need be the 'whipping boys' for publicity seekers, selfish interests or others who conceal a hidden gimmick behind their contrived utterances."

Watrous Bluntly Criticizes

Watrous singled out the truckers and petroleum groups for blunt criticism. In reviewing the experiences of Western highway officials in their dealings with state legislatures, he commented as follows:

"Far too many of us have permitted ourselves to be confined within the template of fear and frustration fashioned for us by our critics. We have attempted, in many cases, to guide public sentiment by use of a slide rule. There has been too little study of the human question, too little plain, honest, forceful speaking.

"There are notable examples of plain speaking here in the West—and if that privilege of getting things off our chests is not to be exercised in the great open spaces, then the highway industry is in sorry straights, indeed.

"It used to be that whenever a desperate highway department sought to obtain an increase in gasoline taxes, or to impose higher fees on trucks, it immediately became the target for insidious propaganda or outright abuse from what we sometimes referred to as 'selfish interests.' And for the most part we sat and took it. We didn't want to 'offend' anyone.

"We all should be proud that in some states—including several in the West—these selfish interests have been dragged from behind the mask of 'do gooders' and plainly branded as the trucking and petroleum groups."

Hale Looks to 1954

Speaking at luncheon, Hal H. Hale, executive secretary, American Association of State Highway Officials, made headlines by warning that the American people must soon decide whether they want better roads or curtailed highway use. Adequate taxes are the only way out. Continued over-crowding of obsolete roads, which contributed to the 38,500 traffic deaths and 1,500,000 reported traffic accidents in 1952, will force such a decision, he said.

Congressional leaders who have just concluded extensive road hearings ordered by the President are now in possession of the most complete analysis of road problems ever presented to Congress, said Hale. As a result, they are prepared to move speedily when Congress convenes after Christmas, and new federal-aid road legislation for the next biennium should be taken up early in 1954. Hale is confident that the present sound policies of federal highway aid will not be greatly disturbed, although he declared that radicalism is a great danger, now that roads have become big business and everybody is coming up with his own ideas.

Foreseen as a possibility is the increase of federal highway support from the present $575 million annual rate to perhaps $800 to $900 million. The latter figure is about the sum collected through the federal 2-cent gasoline tax, for which no repeal is believed to be in sight despite much agitation from various quarters. The new federal legislation may give attention to the problem of financing costly rights of way often required well in advance of construction.

Hale reminded that while enlarged federal highway support is desirable, the state and local governments must continue to be the key to highway financing and administration; too great a federal share would result in undesirable federal domination.

Along with many other organizations concerned with roads, the AASHO is having to examine its policies and revise them to fit today's new needs, the western officials were told. At the national Association's coming annual meeting in Pittsburgh this November, three foremost questions must be decided: a new policy statement on federal aid; what is to be the AASHO policy on toll roads (without reference to the merits of toll roads); and, whether to go ahead with the proposed $9,000,000 AASHO traffic test road in the Middlewest, or modify or drop the project as presently planned.

Technical Session Notes

Following are brief notes and comments on a few of the other papers and discussion topics at Santa Fe.

Washo Test Road. The traffic test program has progressed throughout the past summer on this bituminous project, located in southern Idaho. Earle V. Miller, state highway engineer of Idaho, in reviewing some of the techniques and problems, said that road behavior conclusions would not be available before next summer. Part I of the test report covering planning and techniques will be issued in November of this year.

WASHO Elects Miller, Erwin, for 1954

Earle V. Miller, state highway engineer of Idaho, was elected president of the Western Association of State Highway Officials for the coming year, succeeding Mark U. Watrous, Colorado. C. O. Erwin, state highway engineer of New Mexico, is vice-president; William E. Willey, Arizona, is secretary-treasurer. Added to executive committee: D. C. Greer, Texas; W. A. Bugge, Washington; and W. C. Williams, Oregon.

While release of behavior data is yet well in the future, certain trends were discussed by Mr. Miller. Outstanding among these is the striking difference in behavior of the pavement in the outer wheel path near the pavement edge, from that in the inner wheel path on this two-lane road. Almost without exception in the thin, underdesigned test sections where failures have occurred, the outer wheel path failed first. And in many sections no distress is apparent on the inner wheel path to date even though the outer path had failed months previously. "This may indicate the extreme benefit which may be derived from paved shoulders of some unknown width beyond the outer wheel path," said Miller.

Truck Taxation. This controversial subject was covered by two papers of major length, the findings of which are in serious disagreement. Jess N. Rosenburg, general counsel for the Western Highway Institute (representing truckers), gave a scholarly and thought-provoking analysis representing his industry's viewpoint. His plea was that there still isn't sufficient data on which to base any immediate new tax regulation affecting the truckers.

R. H. Baldock, state highway engineer of Oregon, in outlining economic studies, legislation and aid policies in his state, included statements which flatly contradicted the previous speaker on several points. Engineering analysis in Oregon has shown that truck owners should pay about 30% of highway costs, by virtue of their numerical ratio and of the increased roadbed and bridge strength required for heavy axle loads. The current tax contribution of truckers in Oregon about matches this percentage.

Mr. Baldock also took the opposite viewpoint from Mr. Rosenberg on the question of the weight-mile method of taxing trucks. Whereas the Institute representative claimed that this type of tax is enforceable only at prohibitive administration and policing cost, the Oregon experience shows the current ton-mile tax to be collected at a cost of a very small percentage of the gross receipts.

Engineer Shortage. The effect of the shortage of engineers on the highway program was discussed by Charles E. Waite, assistant state highway engineer of California. Mr. Waite who is in charge of personnel for his organization said that we must find means of stretching technical manpower. The California division of highways has made good progress by a combination of (1) hiring of more subprofessional people, having greatly stepped up this part of the staff, including 120 women draftsmen; (2) expanded and intensified in-service training; (3) a recruiting program beginning in high schools; and (4) research in efficiency of office methods.

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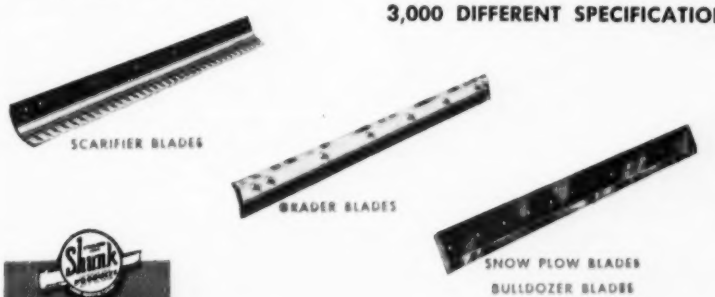

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ods have been the subject of an elaborate study by a special task force, following which design leaders from all districts have met and threshed out ideas. Innumerable ways were found to simplify preparation of contract plans—where lies the greatest potential waste of technical manpower, in Mr. Waite's opinion. The short cuts include such seemingly minor steps as, for example, utilizing larger contour intervals on projects where conditions permitted; and they have especially included the fullest use of such major new techniques as air mapping and photogrammetry.

Much "deadwood" thinking and inertia are likely to be found throughout office practice, said this speaker, and a planned program of combing over existing methods and exploring new, is one means of handling growing road programs with existing personnel. Sound management practices, such for example, as giving design leaders no more men than they can direct efficiently are among the obvious approaches.

Compaction Specs Reviewed

The ins and outs of embankment construction procedures were discussed at two different sessions at the Santa Fe Washo meeting. Lengthest airing came at the all-morning panel meeting on construction. W. J. Walsh, staff construction engineer, Colorado, started the discussion with a paper entitled "A Sound Earthwork Structure—How Far Have We Come? Colorado's present grading specifications require compaction of A-1 and A-3 soils to 95% density and 90% for other soils by the modified AASHO test method. Highway department engineers have been plagued with occasional disconcerting results in connection with high-swell soils, which have absorbed moisture and heaved pavements as much as 6 in. He questioned the advisability of applying these tough density specifications for soils having a swell of more than 3%, and suggested that dropping back to the standard T-99 test might be a good policy generally for road work.

This speaker reviewed recent bids and costs in Colorado, noting that for work totaling some 5½ million cubic yards bids have averaged 6.6 cents for rolling and compaction, or 23½ per cent of the 27 cent average bid for unclassified excavation. On individual jobs, however, this item has ranged from 1 cent to 23 cents. Any bid over 6 cents is considered high. Mr. Walsh concludes that in his state, at least, a stagnation of rolling methods has been brought about by the practice of specifying both the density and the detailed equipment and rolling methods. He suggested that the separate items of furnishing water, furnishing certain equipment on the job, and rolling time be consolidated as part of the unclassified bid item, giving the contractors a chance to use their ingenuity.

Are not contractors and their suppliers better qualified than the engineers to select and apply the new rolling equipment now available, this speaker asked.

In discussion, I. E. Russell of the Wyoming highway department traced this tendency for engineers to specify procedures to the early days when density was first urged by Public Roads and the engineers didn't know what it took to get the compaction. Now it is difficult to change the customs that contractors have become used to, including separate payment for everything they do. Wyoming contractors balk at the suggestion of a single bid item for embankment in place, as being too risky, Russell said.

A Kansas contractor, M. Claire Miller, vice-chairman of the AGC highway contractors division, said that the opposite point of view prevails in his state, where rolling is never a separate pay item. There is however a fixed separate price for water, which contractors don't like very well because they must gamble on the weather in water use. Miller said he prefers the Kansas way, under which he is free to bring in equipment only as needed, compared with Colorado and other state specifications requiring the furnishing of specified equipment on the job as a pay item. He explained that the Kansas method eliminates a lot of equipment standby cost, and puts the contractor on his mettle to work efficiently. For example, on scraper work, equipment routing alone often does the compacting and sheepsfoot rollers are not needed. You see motor gradermen working to maintain a smooth grade at all times, since this facilitates faster, cheaper compaction. The contractor is also encouraged to route his equipment systematically over the grade, rather than along one smooth haul path, the latter being the easy way out as long as rolling is paid for separately on a roller-hour or roller-foot basis. Miller suggested a separate item for water, since water requirement is rather unpredictable, but no other separate items.

Committee Discusses Payment

At a meeting of the AASHO-AGC joint committee, with H. D. Mills of Nevada presiding, the question of separate payment for compaction again came up. A. E. Holcombe of Nevada described his state's method which includes a lump sum for furnishing of sprinkling equipment, an item for water per M gallons on the road, and an hourly rate for foot-hours of rolling including operator. He said the contractors favor this, partly because it removes controversies over engineering decisions.

A new Mexico contractor voiced a similar attitude on the part of his brethren, saying that sometimes prolonged rolling will fail to secure the specified density, in which case the engineer will call it quits and accept the work at a lower density.

An Arizona engineer made an important point by noting that "if we have to bid embankment in place, we bid the engineer," meaning that there is a great difference in the amount of watering and rolling that one engineer will likely require, compared with another. "We have good engineers and better engineers," he said.

W. J. Walsh of Colorado in turn caused a stir by bluntly calling the practice of separate water and roller payment "force account work," a phrase repugnant to contractors. He pointed out that when the engineer specifies the number of rollers, the weight, size, contact pressures and other details, he is in effect running the job on a force account basis. The contractors under such circumstances aren't as afraid of the soils as they are of the engineer.

Engineering Costs on the Up

As a final observation on this general subject, W. J. Walsh observed that "something is happening to our engineering costs and they aren't coming down." The upward cost trend he attributes partly to the elaborate records now required on all jobs. "We are going nuts on compaction," he said, "and are having to pay a great deal to keep records on roller hours, gallons of water applied, etc., etc." In noting that this problem is not confined to any one phase of road work, he suggested a special WASHO committee to review the subject of enginering costs and related details.

A Los Angeles earthmoving contractor suggested a simple "in place" specification for jobs requiring up to 90% density and more elaborate specifications where 95% is wanted or where rolling difficulty is foreseen. This delegate, who specializes in city, county and subdivision work, said that he often hires a private soils engineer to run compaction tests, rather than wait on the slower test reports from the constructing agency while bringing up his fills.

An Oregon contractor reported that rolling has never been a separate pay item in his state. In the last few years, however, the state has sometimes specified the type of roller, without any pay item. This requirement is now being abandoned, and state engineers have agreed to set up a separate pay item if and when roller details are specified in the future.

Earle V. Miller, Idaho state highway engineer, capped this inconclusive discussion by pointing out that the contractor is usually more progressive in adopting new methods than the engineers are in changing their specifications and should be given more initiative. A California engineer echoed this statement by saying that "you take on a lot of the contractor's management function when you tell him he has to have certain equipment on hand."

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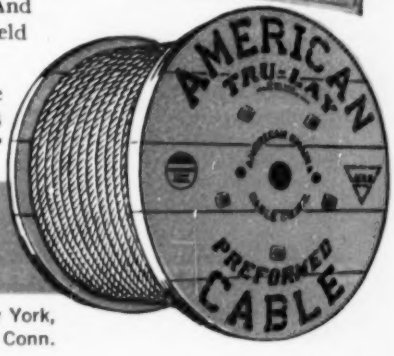

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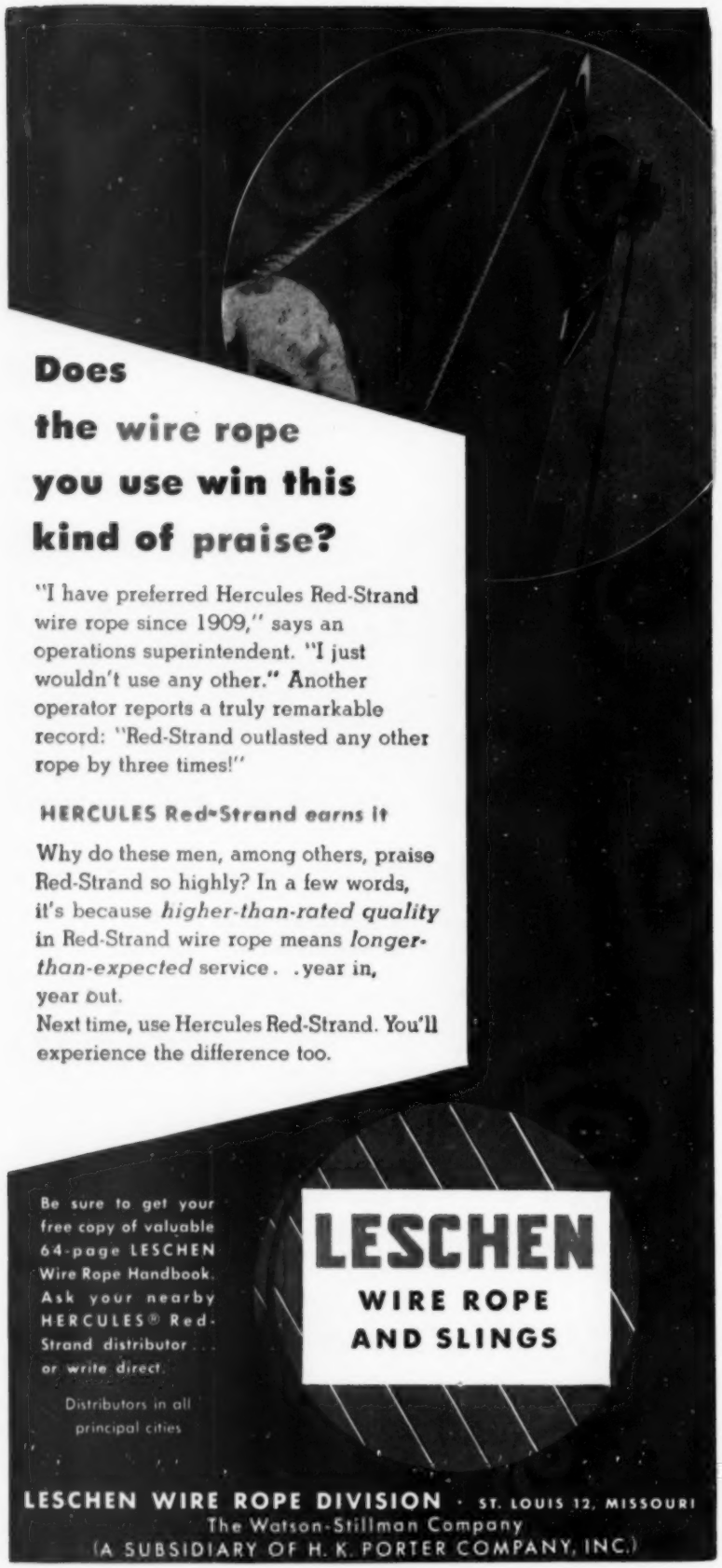
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Salt Stabilization

(Continued from page 49)

shape, will compact into a good salt stabilized road.

Good drainage and grade is important in the construction of any good road and same holds true in the building of a salt-stabilized base; if either is poor, proper correction should be made before constructing the stabilized course.

Salt stabilization should be effected to a depth of at least 3 inches from the finished surface and not over 4 inches in depth. The mixing of the aggregate can be either by plant or in place. When plant-mixed, salt should be added at the rate of approximately 6 lb. per cu. yd. and material laid in 1 or 1½ in. layers, and compacted until desired thickness of road is attained. The salt company, while recommending a mixer, points out that a good job can be done with blades.

Salt stabilized roads are built for wearing coarses for low cost farm-to-market or secondary roads, and outlying city streets, and are adaptable to shoulders along rigid road construction; also for base courses for highways, city streets, airport runways, etc., under bituminous or concrete surfacing.

Another Salt Job

Recently the first salt stabilized township road in Illinois using Motor Fuel Tax money and put in under contract was completed in Roanoke Township, Woodford County. This road is four miles north of Eureka and east of Route 117. To make this road more dependable by conserving the present material as well as to save future maintenance costs, Harold D. Imhoff, Supt. of Woodford County Highways, and Albert Aeschleman, Township Commissioners, thought it necessary to salt-stabilize two miles. Bids were opened on July 24, 1953, and the surfacing contract let to John Berg, Louis Meier and Robert Peters of El Paso, Illinois.

After the grading was done by the township, approximately three inches of crushed stone were added, the road was scarified 4 in. deep, and water was added to keep fines from separating. The material was mixed and spread to proper width. Salt was spread on the basis of 4 tons per mile using a lime and phosphate spreader. The entire material was watered, Seaman-mixed, and bladed to both shoulders. The center was then wet down, and the motor patrol brought back the material an inch at a time from each shoulder. A rubber tired roller followed. Water was added from time to time as it was necessary to keep the material wet. It was rolled until the material began to set. Free water was added and rolling continued for several more hours.

Woodford County now has three salt stabilized roads.

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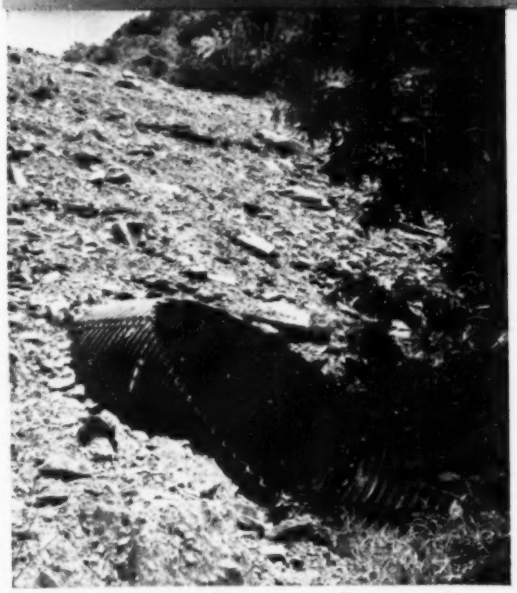
Rugged terrain and steep hills mark the Cabin Run portion of the 88-mile turnpike between Charleston and Princeton. Contractor on this section, Ralph E. Mills Co., Frankfort, Ky.



A typical Toncan drainage installation at Cabin Creek north of Sharon. This is an asphalt coated, 84-inch, beveled Toncan Iron Sectional Plate Pipe. Contractor, Nello L. Teer, Durham, N.C.

To insure proper drainage, Toncan Iron Drainage Structures are being installed at many points along the route of this new pike. Once in place, these structures will maintain their water-carrying capacity practically unchanged for years. Shifting subsoil and settling backfill will not fracture or crush Toncan Iron Pipe. Frost and erosion will never cause spalling to reduce water-carrying capacity.

Because Toncan Iron contains twice as much copper as ordinary copper-bearing steels and irons . . . plus just the right amount of molybdenum to make the copper most effective in resisting rust . . . the West Virginia Turnpike will get years of trouble-free service.

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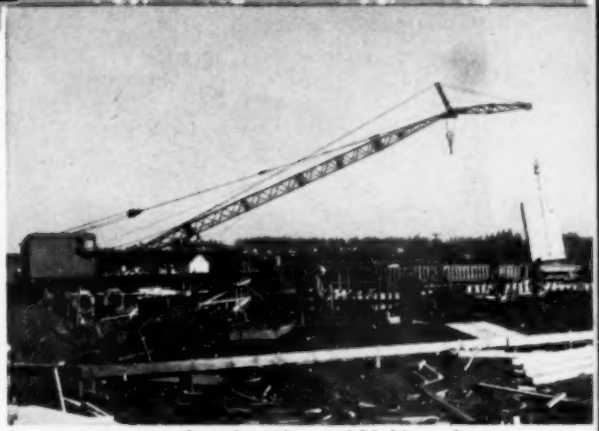
"Couldn't Kink Them, Even When We Tried," Says owner of an Eastern construction company.

Only Tuffy Slings give you the patented 9 part machine-braided wire fabric construction that resists knots and kinks . . . stands up longer than ordinary wire rope under rugged use. The 9 parts are interlaced in an exclusive way, forming a fabric that can be repeatedly bent around small radii and abrupt corners. You'll find Tuffy Slings are extra flexible, extra strong—and they can save you up to 40% on sling costs! Remember, they're proof tested to *twice* the safe working load.

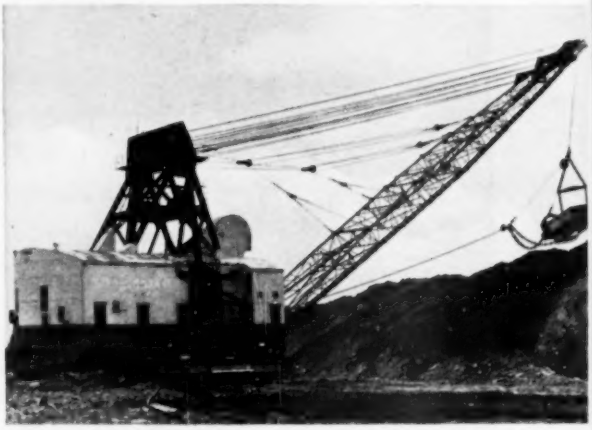


No need to worry about knotting and kinking when you use Tuffy Slings.

Tuffy DRAGLINE

"Best Wire Rope Service . . . on 33 Draglines" Says Superintendent of a Florida rock producing company.

Easy to handle, Tuffy Draglines are designed to take sharper bends, angle pulls and rapid line speed. Wires of finest steel provide extra flexibility without sacrificing other qualities . . . and you'll find Tuffy Draglines have a super tough construction for maximum resistance to drum crushing abuse, crawling on guide roll flanges, etc. Union-formed (pre-formed) Tuffy construction stands up longer than ordinary wire rope under line pull, multiplied shock of load on slack line and the stress of all types of material! Tuffy is easy to order, too! All you need is—length, diameter and the name . . . "Tuffy!"



On jobs like the building of Dams, Tuffy Draglines give dependable performance on any type of equipment.

UNION WIRE ROPE CORP

union
Wire Rope
corporation

Specialists in Wire Rope and Braided Wire Fabric

Tuffy SLINGS

Tuffy DRAGLINE

Tuffy SCRAPER ROPE

Tuffy DOZER ROPE

Grading jobs, like this one near Cadillac, Michigan, call for Tuffy Scraper Rope.

Moving overburden at this West Virginia strip mine is the kind of day-in, day-out job where Tuffy Dozer Rope steadily proves its extra worth.

Tuffy SCRAPER ROPE

"Outlast Other Rope Almost 2 to 1" Says a Middlewestern Contractor

Wheel scrapers need a wire rope that will stand up under more varied strains and stresses than hoist or other standard ropes . . . and Tuffy Scraper Rope fills the bill! Each strand is pre-shaped, which relieves it of internal stresses. This leaves the full strength of every strand free to carry its share of the rope load. Tuffy Scraper Rope is flexible enough to stand up under sharp bending, hug sheave grooves, and wind snugly and smoothly on the drums. Tuffy is so designed to resist drum crushing caused by rope cross-overs. What's more, no complicated specifications are necessary when you order Tuffy! Just ask for Tuffy Scraper Rope and specify diameter and length.

Tuffy DOZER ROPE

"A Reel of Tuffy Dozer Can Save Up To 300%."

Wire rope gets extra-rough service on a dozer, and Tuffy Dozer Rope was specially created for the job. But Tuffy engineers went even further . . . they designed a reel to mount on the dozer and help you stop rope wastage. When rope is cut or crushed on the drum, you just feed through enough from the reel to replace the damaged part. You save the 40′ to 50′ that would normally be thrown away! Users report an increase in service of up to 300%! And you'll find replacement takes less than *half* the time usually needed! Tuffy Dozer is a special ½″ wire rope, available in 150′ reels. Use Tuffy on your Dozer —and *save!*

SEND FOR THESE FREE FOLDERS

union Wire Rope corporation

Specialists *In Wire Rope and Braided Wire Fabric*

2200 Manchester Ave., Kansas City 3, Mo.

Please send me the illustrated folders I have checked below:

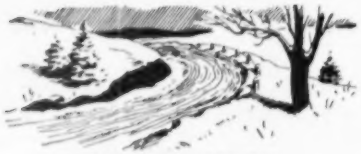
- ☐ Tuffy Dragline
- ☐ Tuffy Scraper Rope
- ☐ Tuffy Dozer Rope
- ☐ Tuffy Slings

Firm Name_____

By_____ Title_____

Address_____ City_____ State_____

STERLING ROCK SALT SOLVES WINTER'S TWO TOUGHEST TRAFFIC PROBLEMS



HEAVY SNOW

Straight Rock Salt converts normal snowfall into slush for traffic to whisk away. Keeps heavier falls "mealy" for quick and easy clean-up by plow.

ICE AND COMPACTED SNOW

Straight Rock Salt's greater melting power perforates and breaks up ice crust, loosening it from pavement, to be worked to the side by traffic or by one pass of the plow.

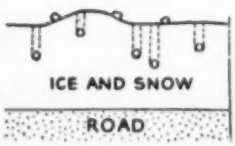
Handle Your Ice and Snow... TEN TIMES FASTER AT HALF THE COST

Ten times faster! One truckload of STERLING *Auger-Action* ROCK SALT covers up to 15 miles per load. The same truck, with abrasives, will cover 1½ miles only. *Rock Salt actually does the whole job—and does it better —in one tenth the time.*

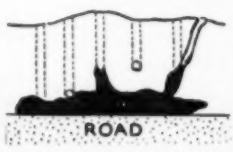
Half the cost! STERLING *Auger-Action* ROCK SALT is easier to store and handle. It spreads faster and goes further. Your own accounting will show the cost per mile for rock salt about *half* that of outmoded abrasive-chemical combinations.

WHY STERLING *AUGER-ACTION* ROCK SALT DOES THE JOB BETTER!

STERLING *Auger-Action* ROCK SALT can be used in any mechanical spreader. Requires no special handling or treatment.



Each salt crystal, generating its own heat, quickly bores straight down through the entire crust of snow or ice.



As crystals reach pavement, they become brine which flows laterally, breaking bond between ice and surface.

Broken ice is easily removed with one pass of the plow or scraper. Heavy traffic spots clear themselves by friction of passing vehicles.

ORDER NOW . . . IN CARLOADS, BULK OR 100 LB. BAGS

STERLING *AUGER-ACTION* ROCK SALT

International Salt Co., Inc., Scranton, Pa.

SALES OFFICES: Atlanta, Ga. • Chicago, Ill. • New Orleans, La. • Baltimore, Md. • Boston, Mass. • St. Louis, Mo. • Newark, N. J. • Buffalo, N. Y. • New York, N. Y. Cincinnati, O. • Cleveland, O. • Philadelphia, Pa. • Pittsburgh, Pa. • Richmond, Va. • ENGINEERING OFFICES: Atlanta, Ga. • Chicago, Ill. • Buffalo, N. Y.

30,000,000 YARD TURNPIKE JOB • •

Earthwork Design and Grading Methods for the West Virginia Turnpike

High Speed $45,000,000 Project Shows

• Largest fill on the turnpike—960,000 cu. yd. in early construction stage

• Bigger-than-2½-yard shovels an important factor. Shown here: a 4½-yard shovel on the S. J. Groves & Sons Co. job (Contract 25) and a 5½-yard machine on Contract 24-A, Latrobe Road Construction Company

Productive Capacity of Postwar Equipment

A review of the specifications, field problems, job methods and equipment being used to grade the 88-mile, 100-million dollar West Virginia Turnpike south from Charleston.

By HAROLD J. McKEEVER, Editor-in-Chief

A NEW traffic axis, not merely a new highway, is being created through the West Virginia mountains. Designed as part of an eventual streamlined flow-path between the Pittsburgh - Akron - Cleveland region and the fast industrializing South, the West Virginia Turnpike is perhaps the boldest venture among the Nation's current billion dollar crop of toll road and bridge projects.

The economic planning and general features of the road make a separate story. This report deals chiefly with the grading, which is being performed under 21 roadway contracts aggregating about $45 million in bid prices. These contracts take in clearing and grubbing, roadway excavation and embankment, culverts and drainage, and substructures for all of the 72 bridges and grade separation structures except the four largest, which are under separate contract. Bridge contracts totaling about $8 million also in force are not included in this discussion.

Big Equipment Investment

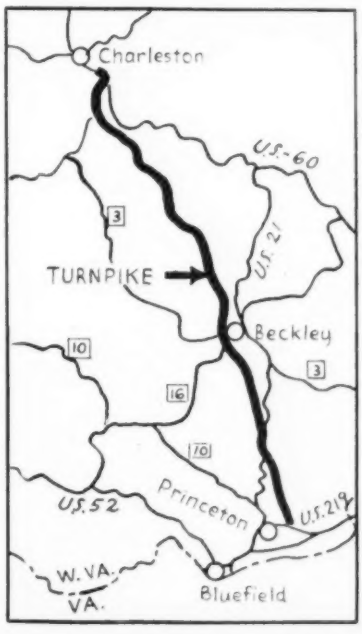
What makes the grading work particularly noteworthy is the explicitness of the specifications pertaining to quality of roadbed, and the large excavation quantities. The yardage varies from 200,000 to 700,000 cu yd. per mile for unclassified excavation alone, this item to total between 28 and 30 million cubic yards when all the slope adjustments and inevitable slide clean-ups are counted in. The excavation will be about 60 per cent rock and shale.

Because of the heavy yardage, high percentage of rock, stiff time limit and for good business reasons generally, the contractors have brought in equipment* which, mile for mile is said to represent the most costly concentration of grading machinery in the history of roadbuilding.

This reporter counted about 1,550 pieces of equipment as tabulated on pages 72-73. This list is approximately correct for main production equipment, but misses hundreds of such items as trucks, trailers, pick-ups, tampers, pumps, shop equipment, etc.; and fails to list separately such units as dozers, power control units, buckets of all kinds, etc.

Over 2,000 Machines

The list also omits the outfits of three of the four major bridge contracts, the concreting equipment on hand with the grading contractors for building the more than fifty major substructures, and the equipment of the scores of subcontractors who handled parts of the clearing, structure work, and other items. Perhaps another 500 units in all, bringing the score to over 2,000.



• The Turnpike's location will tap into the industrialized South

Turnpike's Main Features

The grading contracts were awarded largely during the past winter and spring, last sections in July. Clearing was 50 per cent done by early May. By late June the contractors had reached 500,000 cu. yd. per 6-day week, and by late August had hit near the million mark, there to hold probably until frost.

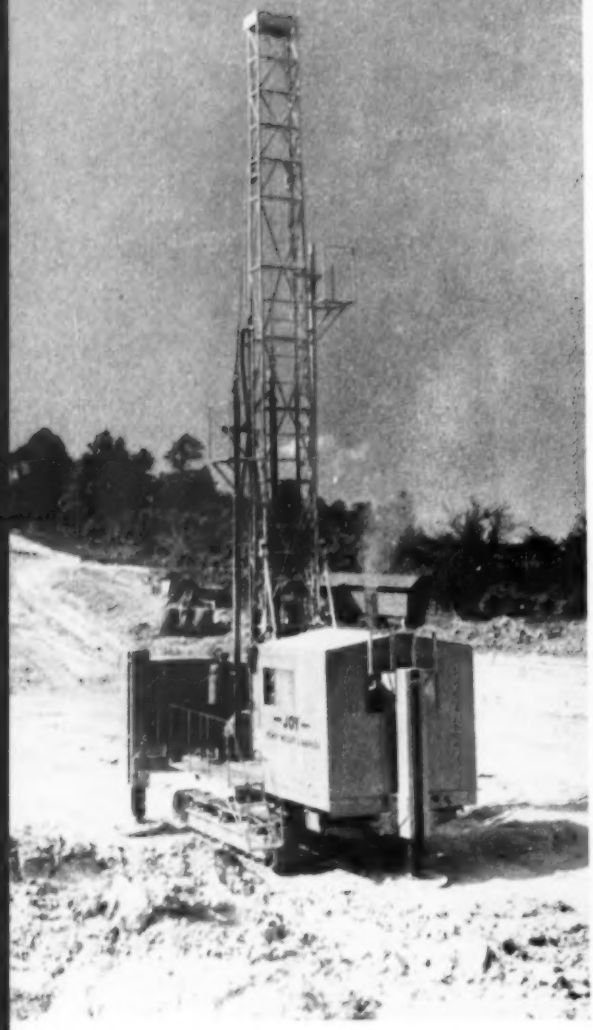
The Turnpike, be it noted at the start, is a 2-lane road except for the liberal use of a 3rd truck lane on grades and for extra lanes near the city of Beckley and at a few other points. This unorthodox and controversial toll road design feature, coupled with limited access, is the final outcome of a decision to go ahead despite financing restrictions.

The road follows a general line south from Charleston, in central West Virginia, to Princeton in the Bluefield coal mining district near the Virginia border. The location, established largely by aerial techniques, follows steep valley sides much of the way. It is roughly paralleled by existing roads, varying from fair to primitive. The maximum grade is 5 per cent. Its line will reduce the thousand-odd curves and 120 miles of distance on the existing route to a direct 88 miles, and perhaps halve the driving time.

The standard roadway section is 50 ft. wide on fills and 46 ft. in cuts, providing 9 ft. prevailing shoulder width. Many miles of extra-width grades are being built with waste or otherwise cheap yardage in anticipation of future dualization.

The road begins at Elev. 600 along the Kanawha River near Charleston, rises to a maximum of 3200 ft. at Flat Top, about 68 miles south, and

*Mike Walsh, executive secretary of the West Virginia Contractors Association, estimates $100 million in equipment for the $100 million completed turnpike. The consulting engineers say this estimate is high.



• Rotary drills made good showing in all but hardest sandstone. This 5½-in. diesel rig on Latrobe's job

• Truck-mounted 6-in. auger with alloy steel or hardfaced bits made good showing in shale on several contracts

• The horizontal power auger (6-in.) also found occasional use in shale where rock overburden was shallow

• Several contractors used this type of 4¾-in. truck-mounted rotary drill

terminates at Elev. 2000 near Princeton.

An important aspect is the design of cuts. The standard cut includes 15-ft. wide benches with intervening slopes ¼ to 1 for rock and ½ to 1 for shale, corresponding to a superimposed uniform slope of 1 to 1 and 1½ to 1 respectively. Despite preliminary boring studies, many cuts—in keeping with West Virginia experience—have had to be designed in the field to secure stability. And numerous quantity revisions have been necessary as anticipated by the engineers. Several heavy slides inevitably have occurred in opening up cuts. Rock cuts run as high as 256 ft. on the high side. The largest fill is

960,000 cu. yd., and several half-million-yard fills have been necessary.

Balanced excavation has been achieved wherever possible, but on several contracts excavation substantially exceeds embankment; one million cubic yards is being wasted in one 3-mile section. Several sections along streams have required borrow for embankment and long hauls for river-side rock facing. In one place a creek is being relocated for several miles to make room for the road on the canyon floor, requiring 600,000 cu. yd. of dragline work. One 3½-mile section of paralleling state road is being relocated, likewise other shorter sections, to make room for the pike.

Materials Encountered

The Turnpike traverses a mountainous area underlain by alternating strata of rock and shale of Permian, Pennsylvanian and Mississippian periods. The stone is sandstone ranging from stone that disintegrates rapidly into soil materials on exposure, to extremely hard, durable, fine-grained sandstone. The shaley materials also have varied from soft shale to a sandy clay rock that is sometimes as hard as sandstone.

Overburden has consisted of a wide assortment of soils ranging from blue and yellow clay to sand, gravel and rocky mixtures. In general the soils have made good or excellent fill materials.

The greatest single unknown in the grading was the character of materials to be excavated. As an aid in design the Turnpike engineers obtained borings by contract totaling 26,000 lineal feet of 1½-in. soil and core borings and 4-in. auger borings.

At many locations electrical resistivity studies were also made in correlation with borings to determine zone conditions. The Turnpike Commission, however, disclaimed any responsibility for the completeness or accuracy of boring results although the findings were made available to the contractors. Auger borings, especially those taken during construction, have been of inestimable value to the engineers. Light hand augers haven't been sufficient for the job, which required heavy-duty jeep or truck mounted augers with alloy or hard-faced bits. The core borings, on the other hand, often led the engineers into misinterpretation of the data, because the boring contractors did their work too well. The cores were deceptively perfect compared with field conditions.

The contractors in making their own reconnaissances took varying footages of borings of their own, but in general did much guessing based on experience and local advice.* Pilot roads often give good clues as to what equipment to bring in.

Clearing and grubbing while entailing many difficulties due to the steepness and inaccessibility of the work, can be classed as a routine part of the job. Chain saws of course have revolutionized clearing. The timber has run light to medium heavy, being mostly second growth. Much hand axe work has been required. Considerable clearing and grubbing has been subbed.

Grading Requirements

The grading contracts take the work up to "template grade," 24 in. below top of pavement.

The principal bid item is unclassified excavation, which includes the removal and disposal of all materials within the right of way necessary in the grading. It covers stripping, removal and disposal of muck and other unsuitable materials, and materials to be wasted. On earlier contracts the Commission made placing and compacting of embankment a separate pay item, which usually ran about 20 to 22 cents. This item was consolidated with unclassified excavation in later awards. Unclassified excavation was bid variously, ranging from $0.50 to $1.60 per cu. yd. with a weighted average of about $1.24. Award prices generally have far exceeded the feasibility estimates, which in 1951 were based on a weighted average of $0.54 for current state road work plus allowance for extra job speed. The contractors apparently have charged for speed without making any concessions for volume.

Rock and shale cuts have been a source of job uncertainty, both as to quantities and as to type of materials found. Redesign of cuts after partial completion has produced additional pay yardage, but sometimes a yardage costly to excavate, consisting of prisms of material high above the floor. Payment is based on neat lines on the plans or "as ordered," except for rock in mass formation where payment extends 6 in. below template grade and 1 ft. back of or outside benches and slopes.

Embankment Specifications

Embankment material lying more than 50 ft. below template grade is specified to meet requirements for material of A-1, A-2-5 or A-3 classification, AASHO specification M-145, and have a laboratory maximum dry density of not less than 110 lb. per cu. ft. Otherwise, except when Select Subgrade or Porous Fill materials are specified, the fill material may be any stable material that can be properly compacted by specified methods to laboratory maximum dry density of 95 lb. per cu. ft. An exception is that A-6 or A-7 materials cannot be used in the top 3 ft.

To the extent that embankment materials meeting these requirements are available, they must be obtained from Unclassified, Channel, or other excavation, and only after that can the contractor use borrow.

The specifications distinguish explicitly between Soil, Granular Ma-

The Grading Equipment at a Glance

61 shovels	2½-yard size still standard. But seven shovels on six jobs are 3½ up to 5½-yard.
291 wagons	Nearly all end dumps. About a fourth are 22-ton.
264 tractors	95 per cent "heavy."
101 scrapers	About half with rubber-tired prime mover.
39 graders	Forbidden for spreading rock. Mandatory for spreading fill other than rock.
98 rollers	15 are 50-ton rubber-tired compactors.
122 compressors	Mostly 500's or 600's. Many new turbine-type.
190 drills	Wagon drills most numerous. But fifteen large rotaries and power augers made big showing in the sandstone and shale.
Rock bits	Mostly multi-use steel bits. Some carbide insert. Throw-aways little seen.
Explosives	10,000,000 to 15,000,000 lb. will be required. Principally 60% or 40% gelatin extra for harder sandstone. Some 40% extra dynamite. Mostly semi-gelatins for softer rock and hard shale. Split-second caps were standards.
Combined spread	Grading contractors have about 2,000 equipment units worth conservatively estimated at $30 million replacement value, for performing $45 million in work.

*Readers may recall the 9,500,000 cu. yd. excavation required for the Airport at Charleston. [Roads and Streets, July, 1945.] Harrison Construction Company encountered 50% to 60% rock and shale in formation similar to those involved on the Turnpike.

terial (not over 35% passing 200 mesh), Shale, and Rock. Rock is any material that cannot be readily incorporated in an 8-in. loose layer and which after placement lacks fines to fill interstices.

Also carefully defined is Porous Fill, which is any specification material consisting of sand, A-3 soil, gravel, crushed materials or a combination of materials such that 100 per cent passes the 3-in. and not more than 10 per cent passes the 200-mesh sieve.

Random Material is specified as being any reasonable mixture such that it cannot be given any of the foregoing classifications. Considerable random material has been found.

Where fills are less than 10 ft. deep, measured from top of pavement, the foundation area must be scarified to 12 in. depth and compacted to specified density. For all fills, the original ground is benched if sloping steeper than 3 to 1.

Power Grader Required

Material other than rock is placed in 8-in. maximum layers, loose measure, each layer being placed full width of the embankment before proceeding with the next. A power grader is required for spreading and bulldozers are limited to auxiliary purposes in order to secure more uniform, accurate and well mixed lifts and a smoother rolling platform. Considerable attention has been given to discing and other means of pulverizing and mixing before compaction.

Control of moisture has been a problem in view of the desire for speed and high production.

Density of compacted materials when tested in the field must be not less than the densities in the following table, as determined by the modified AASHO method of test.

Max. Dry Density lb. per cu. ft.	*Min. Compaction % of max. dry density*
95-99.9*	100
100-119.9	95
120 and above	90

*Materials of less than 95 lb. not acceptable for embankments.

In placing fills with Shale or Random Materials, the contractors have been required to use secondary shooting, skull crackers or pulverizing methods to assure enough fines to fill voids.

Rolling is also carefully specified for various conditions and types of equipment. At least one roller is required for each 200 cu. yd. per hour of placement, or each 400 cu. yd. if 50-tone compactors are used. The use of trucks, scrapers and wagons is not considered as rolling in lieu of the above ratio of roller units, although the contractor is required to route such equipment uniformly over the work to utilize the compaction thus afforded.

Sheepsfoot rollers, seen on nearly all projects, are restricted to heavy units weighing at least 3,400 lb. per lin. ft. of drum and 500 psi. on foot areas, with feet not less than 8 in. long.

Pneumatic tired rollers must weigh not less than 2,500 lb. per ft. of width with not less than 220 lb. per inch of tire width. Such rollers are required where Granular Materials or Select Subgrade Materials are used. Heavy compactors probably equal or outnumber the common small rubber tired rollers on the turnpike work, about half of contractors having one or more such units. Random Materials may be compacted by any combination of sheepsfoot and rubber tired rollers. Porous Fill material required behind abutments must be placed in 6 in. loose layers and compacted to prescribed density with vibrating or pneumatic impact tampers.

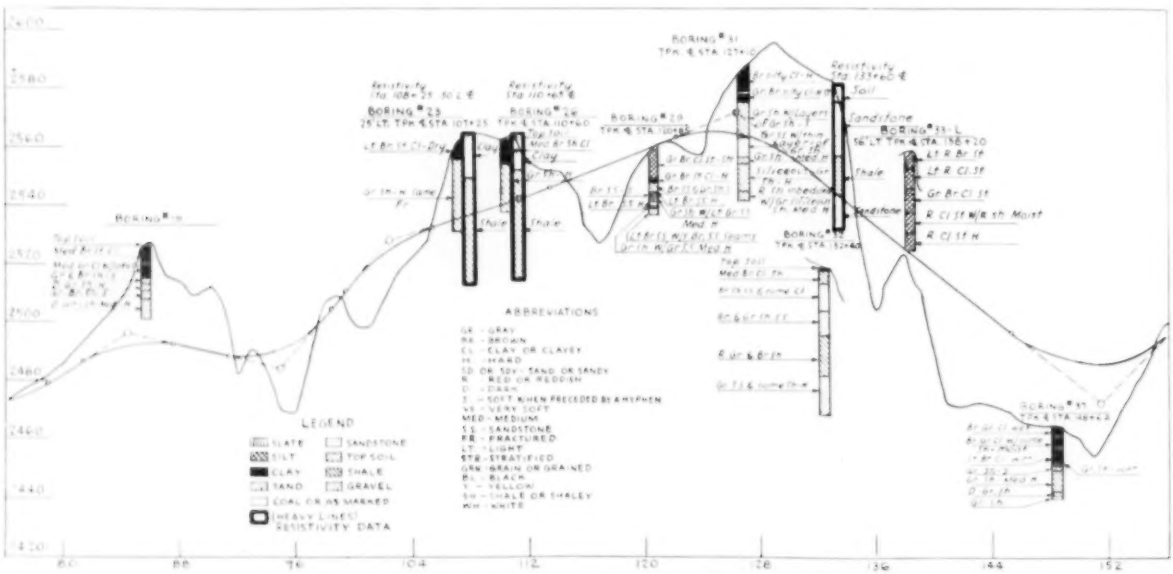
Best density results in all materials except rock have been produced by a combination of a heavy sheepsfoot roller and a 50-ton rubber tired compactor.

Rock Fill Methods

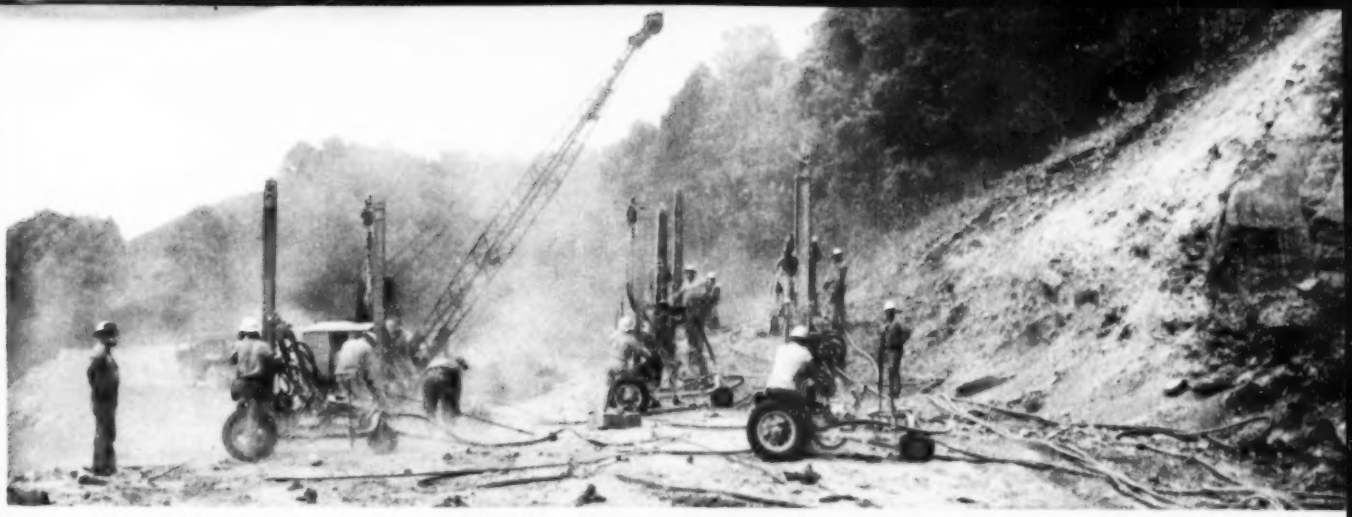
Where rock is encountered in excavation, adjacent fills must be constructed entirely of such rock in accordance with specifications described in the following. In general the rock is to be so placed that it forms the base of the fill. Or it can be used in side slopes of fills previously built with other materials, or in both the side slopes and top of such embankments.

Where embankments are constructed wholly or partially of rock, the rock must be placed so that large stones are well distributed and the interstices well filled with smaller stones, soil, sand or gravel to form a solid embankment. Rock fills are built in layers not exceeding 2 ft. and "preferable not more than 1 ft." Stones too large for such layers must be broken down.

Where insufficient material other



• **Extensive core boring data, correlated at times with electrical resistivity readings, were valuable as a general design aid but were not always too helpful to the contractors**



• **Wagon drills were still "king" on most Turnpike contracts. This gang part of 34 rigs used by one contractor**

than rock is found in the excavation, the contractor, in order to properly choke the courses, is required to distribute rock spall uniformly and work it in. This has been a common method of fill construction, requiring close attention by both inspector and superintendent and skillful spotting of loads by the drivers. One contractor was observed using a dual sheepsfoot roller with a heavy tractor to break up spall and work it in. This made for rough going for the sheepsfoot, but the method was highly effective and left a well filled and keyed lift. (See photo.)

Rock is permitted in the upper lifts (except top 3 ft.) where indicated on the plans, in which case the outer fill slopes are to consist of rock placed 3 ft. in depth throughout, with smaller rocks selectively placed toward the fill center.

All rock material is required to be spread with dozers, in contrast with specifications for other types of fill materials. A dozer is considered necessary to spread rocky materials sufficiently to provide uniform distribution and good intermixing. No rock fill material may remain in the dumped position but must be thus transported and mixed.

All fills of predominantly rock materials must be rolled with 3-wheel steel rollers weighing not less than 330 lb. per lin. ft. of width, with not less than five passes.

The top 3 ft. of all embankments is required to be of materials other than rock. When such materials are placed on rock embankment the top of the previous construction must first be sealed with spalls, granular ma-

• **Diagonal toe shots were made here in conjunction with rotary drill holes on top of the bench. Ralph E. Mills—Morrison-Knudsen Co., Section 27**

• **One of the largest through cuts—250,000 cu. yd. of rock. A 3½-yd. shovel used, along with several of the new turbine-type compressors**

The 1500 Equipment Units That Have Delivered Over

Contractor (and Contract Section)	Shovels	Wagons	Tractors (and Dozers)	Scrapers	Graders
(118) Nello L. Teer Company Mile 0-4.8 $699,493	None	None	6-International TD24 5-Caterpillar D8	2-Euclid 9-Caterpillar and LeTourneau	2-Caterpillar 12
(119) R.E. Graham & Sons Mile 4.8-9.0 $1,117,463	2-Northwest 80D 2½-yd.	18-Euclid end-dump	8-Caterpillar D8	2-Euclid twin engine	2-Caterpillar 12 1-Caterpillar 112
(9) C.E. Rethorst Co. Mile 9.0-11.0 $791,636	1-Ord shovel	2-Euclid end-dump 1-Tournapull C 1-Tournapull D	2-tractors	2-scrapers	(No data)
(120) Ralph E. Mills Co. Mile 11.0-14.0 $1,436,765	1-Northwest 80D 2½-yd.	6-Euclid end-dump	9-Allis-Chalmers HD19 4-Allis-Chalmers HD20 9-Caterpillar D6 1-Caterpillar D7	6-Gar Wood pans 1-LeTourneau pan	3-Caterpillar 12
(121) Gordon Cunningham Co. & Peter Kiewit Sons Co. Mile 14.0-20.0 $3,499,417	1-Northwest 80D 2½-yd. 1-Lima 1201, 3½-yd.	10-Euclid end-dump 22-ton 2-Koehring Dumptor	21-Caterpillar D8 1-Caterpillar D6	3-LaPlant-Choate TS-300 4-LaPlant-Choate 2-Euclid 3-Caterpillar DW21	2-Caterpillar 12
(9) Simon Construction Co. Mile 20.0-25.0 $1,250,903	1-Northwest 80D 2½-yd. 1-Lima Bett 1¼-yd.	16-Euclid end-dump 15-ton	24-Caterpillar D8 3-Allis-Chalmers HD19	1-Gar Wood pan 1-Caterpillar 80 1-Caterpillar DW21	1-Caterpillar 12
(23-A) Central Penn. Quarry & Stripping Co. Mile 25.0-32.0	3-Northwest 80D 2½-yd.	27-Euclid end-dump 15-ton	1-Allis-Chalmers HD20 1-International TD24 9-Caterpillar D8	3-Tournapull C 2-LeTourneau pans 2-LaPlant-Choate 22-yd. pans	2-Caterpillar 12
(23-B) Latrobe Road Construction Co. Mile 32.0-36.0 $1,232,693	(See 24-A equipment list below. Latrobe used these units interchangeably on both projects)				
(24-A) Latrobe Road Const. Mile 36.0-41.0 $1,157,146	1-Marion 37 2½-yd. 3-Northwest 80D 2½-yd.	6-Euclid end-dump 22-ton 23-Euclid end-dump 15-ton	1-Allis-Chalmers HD19 12-Caterpillar D8 3-International TD24 1-Cletrac	6-Wood bridge Terra Cobra 2-Electric pans	(No data)
(24-B) Clara Lemel Co. & H.N. Bickerts & Sons Co. Mile 41.0-46.0 $1,036,133	1-Link-Belt 2½-yd. 2-Northwest 80D 2½-yd. 1-Northwest 90 2½-yd. 1-Northwest 76 2½-yd.	12-Euclid rear-dump 15-ton	9-Caterpillar D8 1-International TD24	1-Caterpillar DW20 1-Tournapull C	(No data)
(24-C) H.W. Holt & Sons Mile 46.0-51.6 $2,194,175	2-Northwest 80D 2½-yd. 1-Lorain 820 2-yd.	6-Euclid end-dump 5-Euclid bottom-dump 3-Tournarockers	6-Caterpillar D8 2-Caterpillar D7 1-Caterpillar D6 1-International TD14	3-Tournapull C 2-LaPlant-Choate pans	1-Austin-Western
(25) S.J. Groves & Sons Co. Mile 51.6-57.9 $1,394,541	2-Bucyrus Erie 88B 4½-yd. 4-Bucyrus Erie 54B 2½-yd. 1-Northwest 2½-yd.	35-Euclid end-dump	25-Caterpillar D8	6-LeTourneau pans	2-Caterpillar 12
(26) Groves, Lucchi & Cox, Inc. Mile 57.9-60.9 $1,917,710	1-Lima 1201 3½-yd. 2-Bucyrus-Erie 54-B 2½-yd. 1-Northwest 80D 2½-yd.	24-Euclid end-dump	11-Caterpillar D8 1-Caterpillar D4 1-Allis-Chalmers HD19	(None)	2-Mass 631 1-Caterpillar 12
(12 and 14) Hines & Rogers Const. Co. Bridge $257,999 Tunnel $2,856,043 Mile 60.9-66.3	1-Lorain 1¼-yd.	1-Euclid end-dump 1-Tournarocker	2-International TD18 5-Caterpillar D8 1-Caterpillar D7	1-Tournapull C 1-Tournapull D	1-Galion
(130) Nello L. Teer Co. Mile 66.3-71.3 $2,962,436	1-Marion 8111 4-yd. 1-Northwest 80D 2½-yd.	12-Euclid end-dump 22-ton 4-Koehring Dumptor	2-Allis-Chalmers HD20 9-Caterpillar D8	(None)	2-Caterpillar 12
(27) Ralph E. Mills Co. & Morrison-Knudsen Co., Inc. Mile 71.3-80.3 $6,184,347	3-Northwest 80D 2½-yd. 1-Lima 1201 3½-yd.	29-Euclid rear-dumps	22-Caterpillar D8 1-Allis-Chalmers HD19	2-LaPlant-Choate TS-300 2-Tournapull C 1-Caterpillar DW21	3-Caterpillar 12
(28-A) L.S. Coleman & Co. Mile 80.3-83.7 $706,074	2-Northwest 80D 2½-yd.	9-Euclid end-dump 2-Tournawagon	10-Caterpillar D8 1-International TD24	3-Euclid scrapers 2-Tournapull C	2-Caterpillar 12
(28-B) Bono & Ritchie, Inc. Mile 80.7-83.4 $1,059,750 (Subbid 100% by Nello L. Teer)	1-Northwest 80D 2½-yd.	3-Euclid end-dump	11-Caterpillar D8	3-Caterpillar DW20 3-Caterpillar 80 1-scraper	2-Caterpillar 12
(28-D) Bono & Ritchie, Inc. Mile 83.4-85.9 $689,297	3-Lorain 820 2-yd.	3-Euclid Bottom-Dump 15-yd. 2-Euclid end-dump 22-t 3-Euclid end-dump 15-t	2-Caterpillar D8 1-International TD24 1-Allis-Chalmers TD14	(No data)	1-Caterpillar 12
(28-E) Suber & Co., Inc. & H.G. Foster & Co. Mile 85.9-87.0 $1,584,460	1-Link-Belt K580 2½-yd. 1-Bucyrus-Erie 54B 2½-yd.	6-Euclid bottom-dump 4-Euclid end-dump 15-ton	3-Allis-Chalmers HD20 3-Allis-Chalmers HD19 3-Caterpillar D8 1-Allis-Chalmers HD15	3-Wood bridge terra Cobra 3-Tournapull C 2-Allis-Chalmers TS-300	2-Caterpillar 12
(28-C) Standard Asphalt & Tar Co. Mile 87.4-88.0 $988,977	2-Lorain 2-yd. 1-Lorain 1¼-yd. 1-Northwest 80D 2½-yd.	2-Tournarockers 5-Athey wagons 10-ton 10 dump trucks (Ford, International)	4-Caterpillar D8 1-Caterpillar D6 1-Allis-Chalmers	1-Caterpillar DW21 1-LeTourneau pan	1-Caterpillar 12
TOTALS 88.0 miles $45,434,731	61	291	264	101	39

* Total of grading contracts which include substructures for about 60 bridge and grade separations.

1,000,000 Cu. Yd. Weekly on the West Virginia Turnpike

Rollers	Compressors	Drills	Cranes Draglines & Backhoes	Light Plants	Service Rigs	Automotive	Misc.
2-sheepsfoot 2-Supercompactor 50-ton	2-Gardner-Denver 600 1-Jaeger 105	2-Ingersol-Rand wagon drills	1-Lima 51 1-Northwest 41	None	1-welder 4-hoist trucks	4-trucks	(No data)
4-sheepsfoot 1-Ferguson 50-t	5-Ingersoll-Rand 600 Gyrofio	5-wagon drills	2-Northwest 6 1-Northwest 25	3-light plants	4-Hobart welders 3-service trucks	9-units	(No data)
2-rollers	3-compressors	3-drills	(No data)	(No data)	(No data)	3-units	(No data)
6-sheepsfoot	2-Schramm 315 3-Gardner-Denver	1-Gardner-Denver wagon drills 2-McCarthy 6" auger	1-Northwest 1½-yd. 1-Bucyrus-Erie 22-B 1¼-yd.	(No data)	2-Hobart welders 1-Grayco lube 1-Alemite lube 4-fuel trucks	6-trucks 4-pickups	1-LeTourneau ripper
4-Tournapacker sheepsfoot 3-Huber 10-ton 2-Ferguson 50-ton	2-Gardner-Denver 315 3-Ingersoll-Rand 600 3-Ingersoll-Rand 105	13-Gardner-Denver wagon drills 1-Joy 4½" rotary	1-Northwest 1½-yd. 2-Lima 1¼-yd.	15-Kohler 5 kw 11-Kohler 3½ kw 2-Kohler 1½ kw	1-Hobart welder 1-Lincoln 18 samp welder 1-water truck	15-pick-ups 8-flat beds 2-ton 2-Hes dump 2-Chevrolet dump	2-LeTourneau 2-office trailers
6-Galion 10-ton 2-Tampo sheepsfoot 3-Hess sheepsfoot 2-LeTourneau sheepsfoot	5-Gardner-Denver 500 1-Worthington 500	7-Worthington wagon drills 3-Gardner-Denver wagon drills	1-Link-Belt 1-yd. 1-Koehring ¾-yd. 1-Lorain ¾-yd. 1-Insley ½-yd.	3-Caterpillar 25 kw 3-Kohler	(17 service, flatbed, pickup)		1-LeTourneau ripper 1-Wooldridge ripper
4-Buffalo-Springfield 10-ton 3-wheel 2-Tournapacker sheepsfoot	1-Gardner-Denver 600 5-Gardner-Denver 315 1-Ingersoll-Rand 315 1-Worthington 105 1-LeRoi Tractair 105	8-Gardner-Denver wagon drills 2-Ingersoll-Rand wagon drills	2-Bucyrus-Erie 10-B ¾-yd. 1-Unit ¾-yd. 1-Lima ¾-yd.	5-Kohler	1-Hobart welder 3-welders	9-trucks and pick-ups	(No data)

(See 24-A equipment list below. Latrobe used these units interchangeably on both projects)

3-Buffalo-Springfield 10-ton 3-wheel 2-Ferguson 50-ton 3-sheepsfoot	1-Gardner-Denver 600 3-Gardner-Denver 500 2-Gardner-Denver 315 1-Ingersoll-Rand 600 1-Compressor	15-wagon drills 1-Joy (heavy Wt. Champ. 5½" rotary 1-Joy 3½" rotary 1-McCarthy 6" auger	1-Michigan 1-yd. 1-Northwest truck crane	(No data)	2-Hobart 1-P & H	1-Diamond T 2-Dodge Power Wagon	(No data)
3-Gehbart sheepsfoot 2-Galion 10-ton	1-Ingersoll-Rand 600 Gyrofio 1-Worthington 500 2-Worthington 300	1-Mayhew 4½" rotary drill 8-Ingersoll-Rand wagon drill	1-dragline ½-yd.	4-Kohler	1-Hobart welder	6-service trucks	(No data)
1-Bros 50-ton 2-Galion 10-ton 1-LeTourneau sheepsfoot	3-Jaeger 600 1-Ingersoll-Rand	10-wagon drills (Thor and I-H) 1-McCarthy 6" auger	1-Insley crane 2-Bucyrus-Erie 22H 1-Schield-Bantam	10-Caterpillar 10 kw	2-Lincoln welder	1-Mack	(No data)
1-Bros 50-ton 2-Galion 10-ton 4-sheepsfoot	15-Ingersoll-Rand 600 Gyrofio 1-LeRoi Tractair 105	14-Gardner-Denver wagon drills	1-Bucyrus-Erie 1-yd. 1-Bucyrus-Erie 1½-yd. 1-Lima truck crane	16-Kohler 2-Caterpillar 10 kw.	(No data)	(No data)	(No data)
2-Bros 50-ton 2-Gehbart rubber tired 2-Tampo pneumatic	2-LeRoi Tractair 105 9-Compressors (Chicago Pneumatic Ingersoll-Rand Gardner-Denver)	10-Joy wagon drills	(No data)	12-Kohler 5 kw 1-Caterpillar 10 kw	1-Lincoln lube 2-Lincoln welder 4-Westinghouse welder 3-fuel and water	12-pickups Chevrolet and International	2-office trailers 2-shop trailers
(No data)	3-Compressors 600 1-Compressor 500	3-Ingersoll-Rand wagon drills	3-Cranes (Koehring and Marion)	1-Kohler 1000 kw 1-Onan 5000 kw 1-Onan 3000 kw 1-Kohler 10 kw 1-Mafonnis generator	4-welders	2-units	1-Hough loader 4-pumps 9-power tools
2-Buffalo-Springfiels 10-ton 1-Supercompactor 2-Tampo sheepsfeet	3-Ingersoll-Rand 600 Gyrofio 1-Jaeger 600	6-Gardner-Denver 2-Mayhew 4½" rotary drills 1-Joy 4" air drill on tractor 1-Winter Weiss 4½" rotary	1-Lima 1½-yd.	6-light plants	2-welders 1-lube truck 1-fuel truck	1-GMC truck 1-International 6-pickups 1-low boy	2-office trailers
6-sheepsfoot Gehbart-LeTourneau 1-Galion 10 ton	12-Ingersoll-Rand 600 Gyrofio 1-Schramm 105	24-wagon drills (J-Rand G-D) 2-Mayhew 4½" rotary 1-McCarthy 6" auger	2-Northwest 1½-yd. 1-Bucyrus-Erie 1½-yd. 1-Lima	4-light plants	1-Grayco lube	1-Walter 1-Mack 1-International 1-Fruehoff trailer	(No data)
(No data)	1-Gardner-Denver 500 2-Gardner-Denver 365	2-Gardner-Denver wagon drills 1-McCarthy 6" auger	1-Insley 1½-yd. 1-other crane	(No data)	3-units	5-pickups 1-Dorsey trailer	(No data)
3-sheepsfoot	2-Jaeger 500	4-Gardner-Denver wagon drill	1-Lima ¾-yd.	(No data)	1-Lincoln welder 1-I-R compressor on tire truck	1-trailer 2-pickups	1-office trailer 1-Letourneau K30 ripper
1-Tango 50 ton 1-Tango sheepsfoot 1-Huber 10 ton	2-Gardner-Denver 500 1-other	4-Gardner-Denver wagon drill 1-Harsha (horiz.)	1-Michigan truck crane	(No data)	1-welder truck	5-units	5-shop and office trailers
2-Ferguson 50-ton	1-Jaeger 315 1-Jaeger 105	1-Gardner-Denver	1-Link-Belt 1½-yd. 1-Bucyrus-Erie 1½-yd.	3-light plants	1-Hobart welder 1-Grayco lube	6-units (Ford, Chevrolet, Mack.)	1-Dorsey trailer 1-LeTourneau K30 ripper
2-10 ton rollers 1-sheepsfoot	4-Gardner-Denver 500 1-Ingersoll-Rand 500	6-Gardner-Denver	1-Insley backhoe 1-Insley tractor crane	None	2-welders	7-trucks	2-house trailers 1-ripper
98	122	190	44	107*	66*	120*	39*

*These items incompletely reported.

• The 50-ton rubber tired compactors were a major factor in getting good fill densities fast and cheaply. While not required, they were brought in for economy reasons.

• (Left): Rock spall being broken down and worked into rock lift with a heavy sheepsfoot roller. (Right): Granular material being rolled for valley-bottom location which required moving the creek

terials and soil and rolled to a smooth line and grade.

The Turnpike specifications are equally explicit on culvert drain installation and backfilling. The average contract section includes items covering thousands of feet of bituminous coated corrugated metal pipe and/or concrete pipe. Over 40,000 lineal feet of precast concrete cribbing is also involved.

Million-Yard-Weekly Pace Mainained

Latest report as we go to press: the contactors on the West Virginia Turnpike exceeded a millian cubic yards per week of excavaion for five successive weeks in September and October. Some have reached the clean-up stage; most outfits have worked their cuts down to levels safe for slippery late-season digging.

See page 35 for report on the paving which will be portland cement concrete throughout.

Notes on Equipment

Shovels of course have set the pace along the turnpike. In general each contractor has two or more 2½-yd. shovels, which are still standard, with an average of one shovel of whatever size to each 500,000 or 600,000 cubic yards of unclassified excavation. But this project has seen a considerable influx of shovels of 3½, 4, 4½ and 5½-yd. dipper capacity; five contractors have six such machines among the 60 rock shovels. One contractor has 18½ cubic yards of combined dipper capacity at work on rock loading in a 3 million yard job. Nearly all shovels have worked two 10- or 11-hour shifts.

Most shovels are new or at least late models. The abrasive sandstone has put them to a severe test. During tnis reporter's late-summer visit, two big shovels observed were down for 10-day repair jobs, seriously slowing production. More than one contractor had an extra 2½-yd. as a standby.

Of 290 or so end-dumps counted on 21 projects, perhaps a third are new 22-tonners. The trend to larger wagons matches the use of larger shovels, and points up the importance of maintaining a good balance between shovel and wagon sizes (6 to 8 dipperfuls per load considered most efficient).

Compressors include perhaps 135 or more units, with 600's in the majority. Many are new turbine-type models.

A notable innovation is the use of light-weight aluminum air pipe on two contract sections. Groves, Lundin & Cox used 4-in. line weighing 15 lb. per 20-ft. section, for supplying 130 psi. air pressure to drills operating at 120 psi., with up to six drills per line. The compressors were coupled with a threaded connection to a steel pipe, and the aluminum pipe in turn coupled to this pipe. This firm's 180 ft. of light-weight pipe was joined together with a new-type coupling, designed with pin connection for almost instant connecting or disconnecting. A rubber or neoprene gasket inside the cast aluminum coupling

• A few of the contracts involving valley-floor location saw extensive use of scrapers

• Backfill over culverts was required to be pneumatically tamped for the first lifts. Single and three-legged tampers seen in action

served as airseal.

S. J. Groves & Sons Co. on their job used 2,000 ft. of 4-in. aluminum pipe, with a sleeve-type coupling quickly tightened with two or three bolts.

Rotary Drills Successful

Wagon drills predominate but much attention has been paid to the performance of larger type drills. Wagon drills numbering some 191 were tallied, with as high as 34 on one contract and gangs up to 10 in a single location. According to a composite of data furnished by superintendents, the wagon drills, taking in all conditions, were probably averaging 60 ft. of hole per hour per drill, with 3 x 3 to 5 x 5 ft. the typical pattern. Yield has run 55 to 60 cu. yd. per hour per drill. This is for a wide range of sandstones and shale materials, and for an average of blasts ranging from very small shots to 750 holes.

Rotary drills of 3-in., 3⅞-in., 4¾-in. and 5½-in. bit sizes have played a part on about one-third of the contracts. Six-in. auger drills for shale were seen on as many jobs. The larger rotaries while usually not considered for hardest rock (such as traprock, dolomite, granite, and many limestones) were proving of definite advantage in a wide range of sandstone short of the hardest on this project.

One type of air-blast rotary machine, truck mounted and having a 4¾-in. cone-type rotary bit, has produced 45 to 65 ft. of hole per hour, with as high as 100 ft. per hour in one instance, depending again on rock type and the skill of the operator. In a typical case in deep stone, one of these rigs working on a 10 x 10 ft. pattern produced 277 cu. yd. of rock per hour with a powder factor of 1.2 lb. This production is an eye-opener. Ledge depth for rotaries has ranged from 15 to 55 ft.

Another user of the same type of 4¾-in. rotary drilled on a 10- to 15-ft. pattern, using 4 x 8 cartridges in 18-ft. holes, his longest drill steel being only 18 ft. On this same job wagon drill holes were drilled 18 ft. on 8 x 8-ft. centers, with an occasional try at carbide-bits — again showing the wide variety of methods, which were often varied daily to match wits with fissured, dirt-pocketed rock and varying material strata.

On the other hand, many contractors have preferred wagon drills, feeling that they could gain by securing better fragmentation, less secondary shooting and less trouble in loading, spreading and rolling, by shooting with smaller holes more closely spaced. Small, closely spaced holes produce a better looking cut face, one foreman observed, and finer breakage achieved in this particular instance was needed for the extensive shallow fills.

Huge Explosives Use

The contractors have had no specific restrictions in blasting except the requirement of following standard safety procedures. Heavy insurance costs have forced the use of tight shooting methods in many areas, due to proximity of highways, houses

● Another 50 ton compactor—on the Holt contract.

or utilities.

At least ten million pounds of explosives, perhaps nearer fifteen million, will be required. Because of the supply problem most contractors have purchased from more than one powder company. Company representatives have worked closely with the contractors on technical problems, which have varied constantly.

For tough hard sandstone, 40% or 60% ammonia gelatin, a fast explosive, has been recommended. Also some extra or ammonia nitrate gelatin, such as Hercules Gelatin Extra, Atlas Giant Gelatin or Du Pont Special Gelatin. Several firms have employed 40% ammonia dynamite, one company using this with alternate holes charged with gelatin extra. Another contractor used 40% ammonia gelatin as a bottom charge and 40% extra dynamite at the top of each hole.

For softer sandstone and hard shale the cheaper semi-gelatins have had wide use. These include Du Pont Gelex, Atlas Gelodyn and Hercules Gelamite. These are not quite as water-resistant, but are popular with road contractors, who today use very little straight gelatin.

The foregoing notes are chiefly for wagon drill holes, although some have used the same dynamite in all hole sizes. Latrobe Road Construction Co., for example, has used a semi-gelatin in wagon drill holes and for larger rotary drill and auger holes. With such larger rotary rigs as the Mayhew, with its 4¾-in. bit, most contractors, however, have preferred the semi-gelatins for either rock or shale.

For the 6-in. auger holes in softer shale one powder company has recommended an ammonia type dynamite, which is cheaper and slower explosive.

The powder ratio has gone up in general for the larger rotary holes, although there again this depends on conditions and the experience of the foreman. It hasn't usually been practical to drill beyond the bench, which is generally not over 20 ft., requiring more powder to break out the bottom when holes are widely spaced. With exceptions the ratio has ranged from 0.75 to 1.0 per lb. per cu. yd. for wagon drills, and from 0.5 to as high as 1.5 lb. for larger drills.

Split-second caps have had big use on the turnpike work. These include Hercules Short Period, Atlas Rockmaster, and du Pont MS delays. These short-period caps, which are designed to relieve each succeeding row of holes with 25 to 50 milliseconds of delay, were originally designed to relieve vibration, but are also favored for better breakage. Straight electric blasting caps have had more limited use, mostly for top shots, to break up boulders, for ditch lines, and miscellaneous shooting.

Primacord has been used where caps are considered dangerous due to proximity of high-tension power lines. Groves, Lundin & Cox, for example, used this product under such conditions.

Multi-Use Bits

Virtually every contractor used the du Pont CD condenser-discharge blasting machine. With this type machine, up to 1,200 or more caps can be shot at once, hooking them up 40 per series with parallel connection.

With rock bits as with explosives the problem has been one of supply. Most of the contractors have relied principally, if not entirely, on multi-use rock bits, with such as the Timken D series quite popular. This type of steel bit for wagon drills is favored for cost reasons and also because of several good facilities in the region for hot or cold reconditioning. The sandstones, however, have been tough on wagon drill bits, wearing out the gauge in a hurry on some jobs. Low-cost throw-away or one-use bits with friction connections have had virtually no part in the turnpike work due to preference to the threaded bit.

Carbide insert bits have been used by several contractors, and despite their high cost have sometimes saved money for hardest sandstones. One firm initially stocked up with many thousands of dollars worth of these expensive bits, but switched to steel bits on discovery of widespread theft of bits by local labor. For rotary drills, cone-type bits of several makes and types have been used.

Nothing has been said thus far about scrapers. Despite the heavy going, some scraper work will be required on nearly every contract, and some sections in valley locations have plenty of it. About a hundred prime movers and tractor pans are on hand.

One contractor, Nello L. Teer Company, on Section 18, used pans to clean out a big shale cut or two following blasting, but use of pans for blasted materials has been the exception.

With this general summary, let us look briefly at how several of the contractors have tackled their sections.

Several Jobs Described

Contract 25. S. J. Groves and Sons Company, Minneapolis, Minn.; Sam T. Day, project manager; bid price, $5,865,000. Principal item 3,000,000 cu. yd. of unclassified excavation, the work including a 960,000 cu. yd. fill, largest on the turnpike.

S. J. Groves reached 110,000 cu. yd. per week of six double-shift days in late summer, but slumped along with several other contractors due to late summer shovel breakdowns.

Seventy flat cars of equipment were brought in to rail sidings located fortunately near the job, with three unloading points minimizing trailer haul over the tortuous, narrow secondary roads. Rock is being loaded by two 4½-yd. and three 2½-yd. shovels and two 2½-yd. draglines, the latter being handy also for sidecasting and placing embankment face stones.

Supporting equipment consists of 35 end-dumps, 25 tractors, 34 wagon drills, 15 "600" compressors and other equipment in a spread totaling some

• Showing the rugged terrain, typical of most contract sections. This is the Clark, Ferrel and H. N. Rodgers job (Sec. 24-B)

125 or 150 equipment units. Light plants consist of two diesel powered 10 kw. units with 10 to 20 floods to a tower, and 18 smaller units with 2 to 4 500-watt lamps. The day shift has worked from 5 a.m. to 3:30 p.m., the night shift from 4 p.m. to 2:30 a.m., giving two servicing periods each 24 hours. The operators rotate shifts every two weeks.

Bituminous coated corrugated iron pipe totaling 7,800 ft. is required, the larger diameters being sectional plate pipe. The 15,000 cu. yd. of structure concrete for major bridges is being proportioned at a rail siding and delivered in truck mixers—a typical turnpike pattern. Because of the high organic content of the local stream, a well with electric pump was necessary to supplying mix water.

The Groves shop is one of the largest and most completely equipped on the turnpike. Twenty mechanics, welders, and service rig operators are employed in the two shifts; in all, about 500 men are on the work, including subcontractor personnel.

Contract 21. Condon-Cunningham Co. & Peter Kiewit Sons Co., Omaha, Nebraska; Leo V. Donaldson, project manager. Bid price, $3,499,000. Length, 8 miles. Principal item, 2,500,000 cu. yd. of unclassified excavation.

This contractor became a star performer early in the race, moving 360,000 in May after an April start, and later hitting as high as 135,000 cu. yd. per week, double-shift. Relocation of 3½ miles of paralleling state highway was part of their job.

Out of the famous Kiewit equipment reservoir has come a 175-piece spread which includes four 2½-yd. shovels, three 1½-yd. draglines and backhoes, ten 22-ton end-dumps, 9 large rubber tired scrapers, 20 tractors and related equipment. The job was 185 per cent ahead of schedule in August. The contractor had moved a crushing outfit in and begun stockpiling subbase materials and paving aggregates for a state road relocation in conjunction.

Contract 26. Groves, Lundin & Cox, Minneapolis, Minn.; R. G. Frail, project manager. Bid price, $3,918,000. Length, 10.1 miles. Principal items, 2,200,000 cu. yd. of unclassified and 547,000 cu. yd. of channel.

This project, which varies from the normal, includes the relocation of several miles of creek bed in a canyon, and the construction of road fill with the material thus excavated. The excellent filling material has been excavated chiefly by a 2½-yd. dragline, skilled use of which has left a new drainage channel ready for stream diversion. Material is spread with dozers and compacted by small, heavily-loaded pneumatic rollers drawn by crawler tractors.

This contractor is one of the several that have pinned faith in a 3½-yd. shovel in addition to 2½-yd. shovels. In late summer one shovel was working 500 ft. above a valley floor, and the goal was to get all cuts worked down to lower levels by the Autumn rainy season for reasons of safety and efficiency.

Contract 28-E. Suber & Co., Inc., and R. G. Foster & Co., of Whitmore, S. Carolina; H. S. Lattimore, project manager. Length, 1.1 miles. Principal item, 1,300,000 cu. yd. of borrow excavation, bid at $0.70.

This non-typical contract section involves shallow filling all the way, the highway grade being along the flat bank of the Kanawha near Charleston. Virtually the entire borrow yardage is being obtained from a high "pit" located up the adjacent bluff slope on the opposite side of the C & O mainline, requiring intensive flag and watchman service. As shown in one of the pictures, the pit is perhaps 2,000 ft. long. It was worked by both shovels and scrapers, with almost no blasting.

Working two 11-hour shifts this contractor has moved and compacted 8,000 to 10,000 cu. yd. daily with two 2½-yd. shovels, 6 bottom dumps, 4 end dumps, 8 tractors, 3 graders, 5 rubber-tired scrapers, 2 50-ton compactors, a ripper and 2 draglines.

Rolling of the high-grade talus materials is performed entirely by heavy compactors which have proved ideal for the random mixture of rock, shale, clay and sand.

Contract 10. Nello L. Teer Company, Durham, N. C.; William Bur-

• New type pin-connected coupling for aluminum air-supply pipe was used by one contractor

• Tourists will throng the West Virginia Turnpike to enjoy such scenic vistas as this one. Photo taken from a shovel location 400 ft. above the valley floor. Groves, Lundin & Cox contract.

ton, superintendent. Bid price, $2,952,000. Length, 3 miles. Principal item, 1,800,000 cu. yd. of unclassified excavation.

This contractor by mid-summer was making 55,000 cu. yd. per week, nearly all rock and shale. Due to the shelf location and high back slopes over 1,000,000 cu. yd. of waste excavation is involved.

The three 2½-yd. shovels have worked two 10-hour shifts. Drilling, however, has been accomplished in a single shift, working massive sandstone ledges with 6 wagon drills, one air-operated, tractor-mounted 4-in.

• Oversize shooting was a minor problem on most sections. Mobile compressors speeded secondary drilling.

drill; and three 4¾-in. rotary drills of two different makes. One of the larger drills was making the rather phenomenal progress of 600 to 1,000 ft. of blast hole per 10 hours in the relatively soft sandstone, with holes as deep as 50 ft. in deep side-hill cuts where rock thickness permitted.

With their 4-in. air-drill bits, this firm loaded 3½" x 10 lb. of Gelodyn No. 7; and for the 4¾-in. holes used 4" x 12½ lb. cartridges. Some shots near the adjacent tunnel portal ran to 20,000 lb. per blast.

Contract 27. Ralph E. Mills Co., and Morrison-Knudsen Co., Boise, Idaho; J. M. Lipscomb, project manager. Bid price, $6,184,000. Length, 8.8 miles. Principal item, 3,500,000 cu. yd. of unclassified excavation.

Following the Kanawha River valleyside and a tributary valley slope most of the way, this section was also well advanced in August. Equipment included 5 2½-yd. shovels, one 3½-yd. shovel, 29 end-dumps, 23 tractors, 5 graders, 6 sheepsfoot rollers, 12 "600" compressors, 24 wagon drills, one 4¾-in. rotary drill, and one 6-in. auger drill, with a score or more of other major units.

Well along in the project a fleet of high-speed scrapers came in, working down from first benches notched out by 2½-yd. shovels as they advanced along the valley-side.

The 4¾-in. drill at the time visited was making 550 ft. per 10-hour day in relatively hard sandstone, drilling 30-ft. holes in a bench that was also being toe-drilled through underlying shale by wagon drills on a 45-degree slope. Alternating wagon and rotary drill holes were used successfully at

A 6-in. auger, a horizontal type unit, was used for drilling shale faces underlying relatively shallow rock.

A 250,000 cu. yd. through rock cut on this project (pictured) illustrates the problem of benching into very high, steep slopes.

Contract 24-A. Latrobe Road Construction Co., Latrobe, Pa.; Frank Crowell, superintendent. Bid price, $1,377,000. Length, 5 miles. Principal item, $1,500,000 cu. yd. of unclassified excavation.

This contract is noteworthy for use of a 5½-yd. stripping shovel, working behind drilling equipment consisting of one 5½-in. rotary and one 3-in. rotary for rock and a 6-in. power soil auger for shale. This shovel moved 411 22-ton Euclid loads in a 10-hour shift on the day visited,

• **Another hillside borrow site —all rock—the 300,000-cu. yd. quarry of Boso & Ritchie (Section 28-D) which supplies bank stone for fills along the Kanawha River**

• **Some of the contractors had as many as 20 light plants for all-out double shift work**

• **Look hard and you'll notice the radio mast on this pick-up, used by a superintendent for Groves, Lundin & Cox. Two-radio telephone a major factor in Turnpike job management.**

• **Modern lube equipment was usually mounted on heavy-duty trucks capable of traveling the Jeep trails.**

• Ready-mixed concrete generally being used for substructures, either commercially supplied or from contractor's own batch plant

• One of the best of the field shops on the turnpike—that of S. J. Groves & Sons Co. for 2½-million-yard Section 25

• This 2½-yard shovel is at work on a 1,300,000-cu. yd. hillside borrow "pit" Suber and Foster's valley-bottom job (Sec. 28-E)

and has consistently run 6,000 pay yards or more per double shift, easily handling the largest rock fragments permitted in lower fill lifts. Much speculation existed among fellow contractors as to the advantages of such a large shovel on this section, where grading was by no means heaviest.

Latrobe's large drills also created much interest. The 5½-in. rig was seen drilling 15 to 18 ft. holes in soft sandstone. The charge consisted of National Tungite No. 2 in 4½ x 24 cartridges. This machine was drilling about the same hourly footage as the average wagon drill, with several times the yield per hour. Latrobe's two rotaries and one shale auger, combined, drilled about 2,000 ft. of hole per 10 hours.

Latrobe also worked a fleet of 7-yr. old self-propelled scrapers, veterans of other turnpike jobs, making an additional 4,000 cu. yd. per day or better (day shift only) and bringing the job yardage to about 10,000 cu. yd. daily. This contractor also adjacent contract 23-B of approximately equal size.

Contract 23-A. Central Pennsylvania Quarry Stripping and Construction Co. This company during September moved in a 5½-in. diesel rotary drill, to try larger holes using Atlas Apex quarry type explosive.

Acknowledgments

The West Virginia Turnpike is being built by the West Virginia Turnpike Commission, Charleston, of which Ray Cavendish is executive director. Howard, Needles, Tammen & Bergendoff, consulting engineers, are the general consultants in over-all charge. Construction plans have been prepared by Capitol Engineering Corporation, Dillsburg, Pa., for Section 1 (south end); by Fay Spoffard & Thorndike of Boston, for Section 2 (central); and by Gannett, Fleming Corddry and Carpenter, of Harrisburg, Pa., for Section 3 (north end).

Fay Spoffard & Thorndike are responsible for layout and construction supervision of roadway and bridges on Sections 1 and 2. Gannett, Fleming Corddry & Carpenter have a similar responsibility for Section 3. Howard, Needles, Tammen & Bergendoff have both design and supervision of the three principal bridges.

Singstad & Baillie designed the tunnel for which field supervision is assigned to Howard, Needles, Tammen & Bergendoff. The turnpike is scheduled for opening to traffic late in 1954.

Drilling 20-hours a day with Jaeger 600's

Shooting 1,500,000 tons of rock on new West Virginia Turnpike

14 cuts ranging from 30 to 147 ft. deep, a total of 1,500,000 cu. yds. of excavation, 85% of it rock . . . With this contract, H. W. Holt & Son put three 2½ yd. shovels working two 10-hour shifts and set up to drill and shoot 16,000 cu. yds. of rock a day to keep ahead of the shovels.

They chose the most dependable heavy duty drilling equipment yet developed for rock work — ten 4" wagon drills powered by five 600 ft. compressors, four of them Jaeger "Air Plus" units.

Drilling a steady 20 hours a day, in patterns close enough to insure good fragmentation, even cleavage and a minimum of secondary drilling, these "teams" proved able to average the needed yield of 30 yds. per hour per drill.

Over the 33 mountainous miles of West Virginia's Turnpike (a rugged job if ever there was one), the big majority of air compressors of all makes have been 600's, the "new standard" rating introduced by Jaeger in 1946 and later adopted by all others. As yet, Jaeger "Air Plus" are the only compressors *completely engineered* to the other "new standard" ratings — 365, 250, 185, 125, 75 cfm. Like the 600, they meet the higher requirements of today's tools with adequate air, produced at the lowest known cost per cubic foot.

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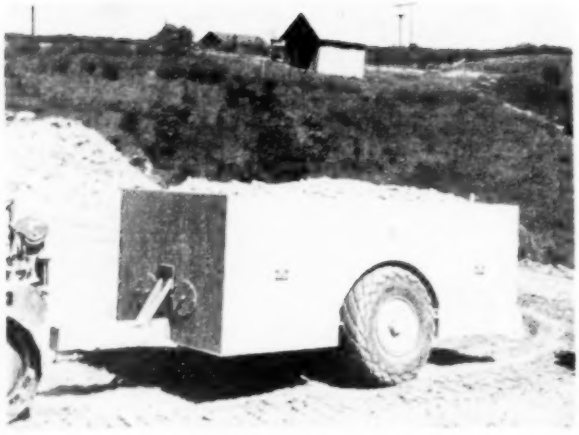
Here's a 50-ton Bros Roll-O-Pactor working on the New Jersey Turnpike near Swedesboro. Range of the 50-ton unit is 9 tons empty to 50 tons fully loaded.



On the 88 mile West Virginia Turnpike, this 50-ton Roll-O-Pactor provides fastest type earth compaction. Tank-type manhole covers make loading and unloading this unit quite simple.

At Ft. Benning, Georgia, this 50-ton Roll-O-Pactor compacted a subgrade of 118 lbs. per cu. ft. fill to densities over 98 per cent.

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When you select compaction equipment for your next big job, keep the Roll-O-Pactor in mind. It's a stable, widely tested, thoroughly approved unit. Widely imitated, it is unmatched for simplicity of design and practical, economical service. Service is conveniently available through the entire Bros factory and distributor service organization. Roll-O-Pactor is patented in the United States, Canada and Mexico.

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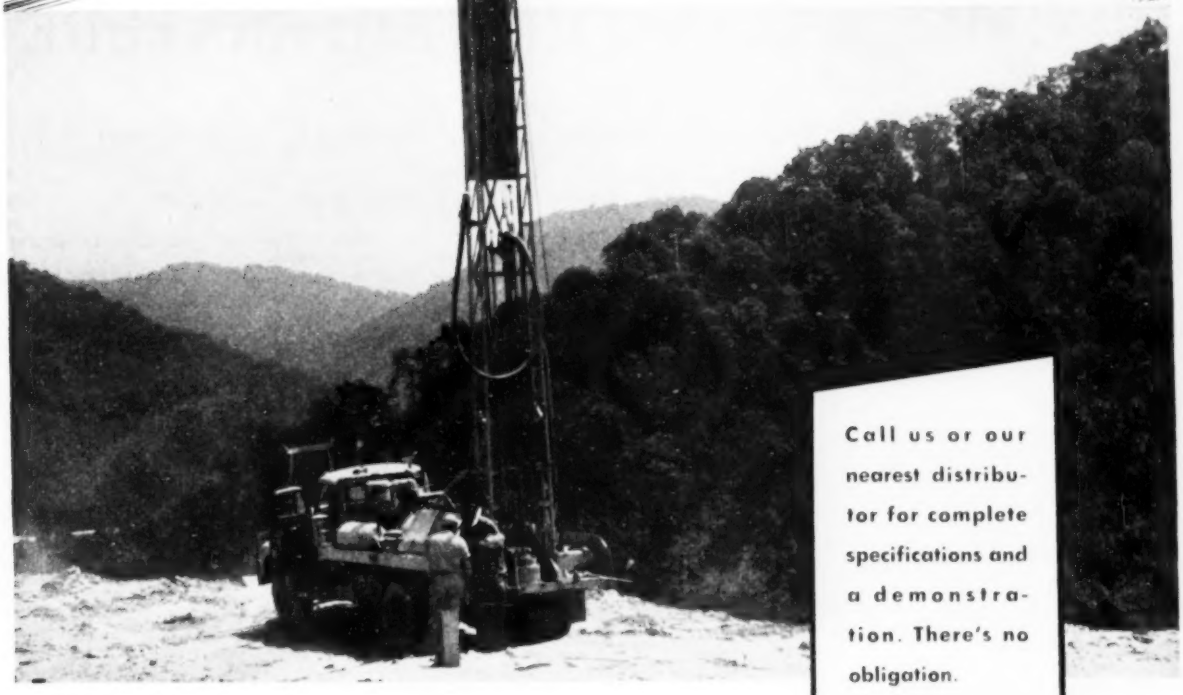

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Through dirt, shale, sandstone, and rock Mayhew Hurricane Drills kept blasting operations far ahead of the earth-moving equipment on the West Virginia Turnpike Project. This Mayhew portable rotary drill, which utilizes air for the removal of cuttings, not only outperformed other type drill units but foot for foot proved the most economical method of drilling blast holes.

Behind these Mayhew Hurricanes is over 25 years of experience in designing, engineering, and manufacturing portable rotary drilling equipment for the oil industry.

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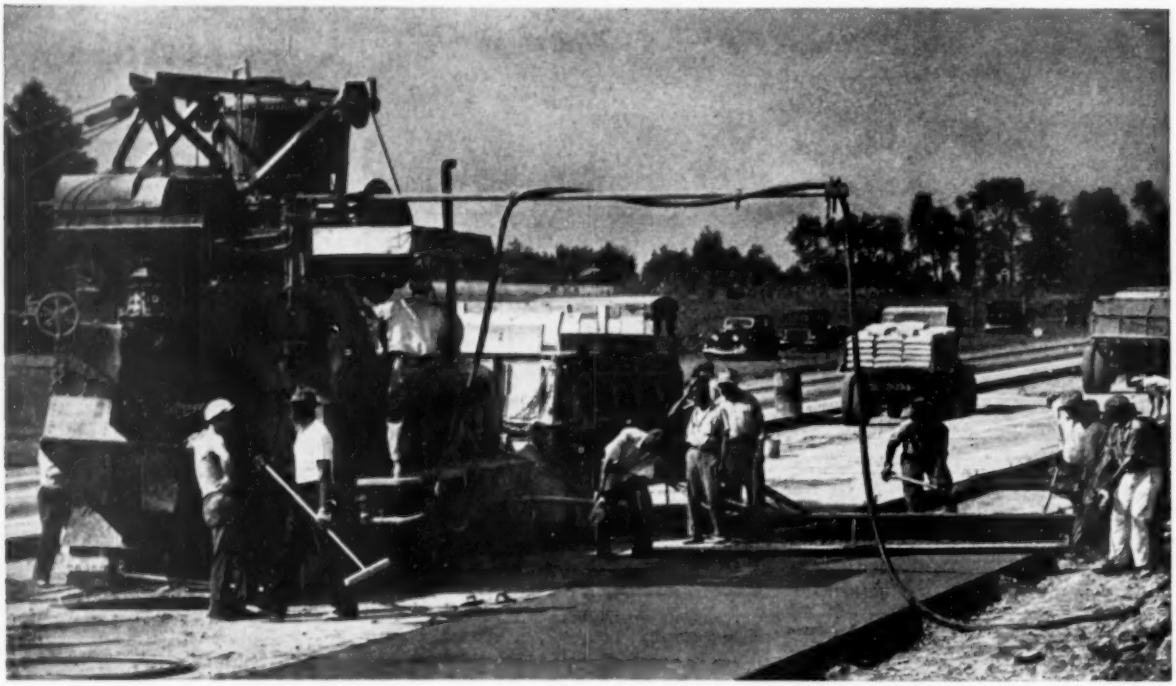

Modern highway construction methods don't permit long wasteful periods of waiting for concrete to gain working strength. For this reason, the use of Dowflake® (Dow calcium chloride 77-80%) as an admixture is extremely important in reducing setting time.

At a temperature of 25°F. plain concrete requires six weeks to attain a strength of 2000 p.s.i. With a 2% addition of Dowflake, at the same temperature, only seven and one half days are necessary, *a saving in time of over 80%*. Naturally, with or without Dowflake, it is necessary to use heated aggregate, warm water, tarpaulins, etc.

At 70°F., Dowflake increases setting time 100%. And at every temperature, Dowflake gives concrete *greater strength*. Dowflake provides curing, too, by reducing the moisture loss during the early hydration period and by accelerating the hydration action while moisture is present. In addition to permitting faster, better work, a Dowflake admixture lowers time and labor costs.

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DOW

Concrete Placing and Handling Manual Issued by Gar-Bro

A REMINDER that concrete construction has come of age is afforded by a new manual on efficient handling and placing of concrete. Unique in the voluminous literature of concrete, this 56-page publication has been compiled by Gar-Bro Manufacturing Co., a division of Garlinghouse Brothers, with A. F. Garlinghouse, Assoc. Mem. A.S.C.E., as editor. The publication is confined only to its announced subject, and does not cover the technical design or the requirements of concrete.

During the past 20 years the art of concrete production and placing has become a science, the manual notes. This is fortunate, for almost every structure built today involves concrete in some form. Precast slabs, beams and other members, tilt-up walls, thin shell roofs and prestressed concrete are some of the newer forms which have become generally accepted by engineers. The industry has learned how to produce air-entrained concrete, how to place zero-slump concrete, how to place high-slump concrete and then draw off the water with vacuum mats, all in the interest of producing better, more enduring and more economical structures. Precision proportioning has become the standard, and concrete of the required quality is now pre-determined by the mix.

To produce and place concrete of the proper characteristics for each structure requires constant and efficient attention. The American Concrete Institute, American Society for Testing Materials, the Bureau of Reclamation, the Corps of Engineers, Department of the U. S. Army, the Portland Cement Association, state highway departments and many other engineering bodies—both public and private—are constantly studying and improving the quality of concrete.

A concrete structure that is adequately designed must be properly constructed to carry the design loads—and built within an economical price and time range. In this way it is adequate not merely in first cost, but also in terms of its ultimate service.

Details of procedure vary, but in all cases the method of handling and placing the concrete is of vital importance. This handbook discusses only "up to date" and approved methods and equipment.

A chapter on basic facts about concrete covers its resistence to thawing, the factors of impermeability and strength, selecting concrete for the job, consistency of concrete, and aspects of air entrainment.

Three chapters then follow on measuring, handling and placing, with references to an appendix describing units in the Gar-Bro complete line of concrete handling and placing equipment that are most appropriate to the discussion at hand. Separate discussions and data cover the subjects of measuring cement by volume, and by weight, aggregates by volume and weight; ready-mixed concrete; how and when to use concrete hoppers, wheelbarrows, hand push carts, powered carts, buckets, pumps and conveyors; depositing of concrete; collection hoppers and drop chutes; straight-line chutes; concrete bucket attachments; and placing concrete under water.

Placing Concrete Properly

The following statements are taken from page 17 of the Gar-Bro manual, as an example of the useful data presented within its pages.

Concrete should be placed as nearly as practicable in its final position. It should not be placed in large quantities at a given point and allowed to run or to be worked over a long distance in the form. This practice results in segregation, because the mortar tends to flow out ahead of the coarser material. It also results in sloping work planes between successive layers of concrete. In general, the concrete should be placed in horizontal layers of uniform thickness, each layer thoroughly consolidated before the next is placed.

In high walls the concrete should be placed to a point about a foot below the top and an hour or so allowed for settling. Concreting should then be resumed before set occurs to avoid a cold joint. A stiffer consistency can be used in the upper section because the concrete is accessible for puddling. The form should be overfilled and the excess concrete then cut off by screeding after it has partially stiffened. To prevent segregation the concrete should not be allowed to drop freely more tahn 5 to 6 ft.

In narrow walls with closely spaced reinforcing steel, collection hoppers with rectangular discharge openings should be used, to which are attached various single lengths of rubber elephant trunk type drop chutes.

In wider walls collection hoppers with round discharge openings can be used with flexible type steel drop chutes. These steel drop chute sections can be removed by unhooking as the pour progresses.

In open areas where space permits, good results can be obtained by direct vertical dumping from concrete buckets with the proper attachments.

In slab construction, placing of the concrete should be started at the far end of the work so each batch will be dumped against previously placed concrete, not away from it. The concrete should not be dumped in separate piles and the piles then leveled and worked together.

A copy of the manual is available on request to Gar-Bro Manufacturing Co., 2415 E. Washington Blvd., Los Angeles 21, California. Please use business letterhead and give occupation and title when writing.

★ Collection hopper and powered cart speed concrete to forms

★ The California trainees prepare to take notes on a movie film

Classroom on Wheels

FOR CALIFORNIA STATE HIGHWAY EQUIPMENT MEN

THE California State Division of Highways owns and operates some 6,000 units of maintenance, construction, and other equipment valued at more than $18,000,000, and controlled and administered by the Division's Equipment Department.

One of the most recent innovations aimed at increased efficiency is the establishment of a classroom on wheels, where specialized on-the-job training is offered to mechanics and operators. This training is designed to advance their knowledge and improve their techniques. The purpose of course is to cut upkeep costs resulting from inadequate repairs and adjustments and from improper operations. The new program is being started in a small way, with only the mechanics and related trades in the Equipment Department itself. Later, this department expects to cooperate with the Maintenance Department in making the training available to their personnel also.

Since this type of program demands instructors of special experience, department leaders feel fortunate in securing the services of Hilton F. Lusk, who heads this work. He is a former professor of engineering at the College of the Pacific at Stockton, California, and was later dean of the Boeing School of Aeronautics at Oakland, and more recently instructor of Mechanical and Electrical Engineering at the Sacramento Junior College.

Since taking over his duties as Associate Equipment Engineer with the state division of highways, Mr. Lusk has been assembling teaching data. In this he has been materially aided by manufacturers, who have made available libraries of instructive films, booklets, charts, diagrams, plans, and other technical material. Automobile companies have offered to supply complete subassemblies such as automatic transmissions, special differentials, power dividers, and other equipment.

The department has been given access to the large library of data and films maintained by the American Public Works Association. Major oil companies have donated technical and practical data, illustrative films and charts, all of which will be used in the first unit of work—the all-important subject of adequate and proper lubrication.

The Department also expects to accumulate its own library of tape recordings of practical and technical lectures given by its own personnel and other authorities.

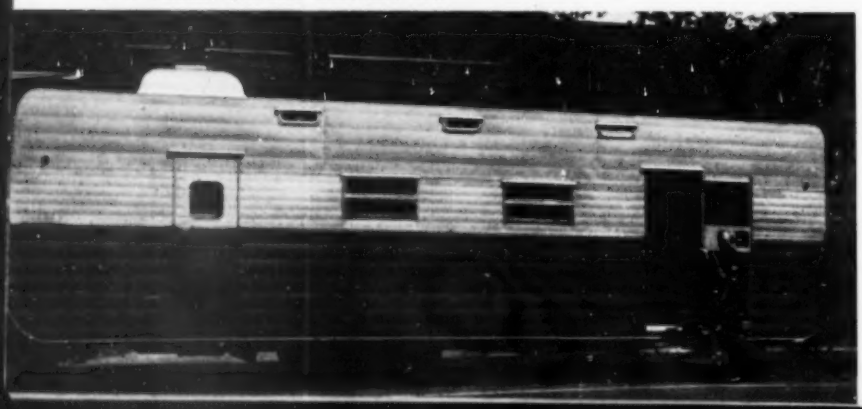
Since the State of California is so large, it seemed impractical to bring all the students together in one central school for training. Thus the idea of the "school on wheels" was born, a school that can be easily and readily brought directly to the students. Attendance records are kept, and employees participating in the training program are given proper credit and recognition.

The department commissioned a Los Angeles trailer manufacturer to construct a 35-foot classroom trailer, fitted with desk seats for 18 trainees, and with up-to-date audio-visual aids to assist the instructors. The trailer has two doors, is well-ventilated, and is equipped with both heating and cooling facilities so that it may be used in both summer and winter and in desert and alpine climates.

The trailer is towed by a truck unit fitted with a special body equipped for safe storage of the complex equipment to be demonstrated. The towing unit also carries an electric generating unit to provide current for operation when public-utility service is not available. Also carried are many mechanical and machine parts and subassemblies needed during lectures and practical demonstrations—a technique found specially desirable in "how to do it" instruction.

As the trailer unit travels around the state from point to point, visiting various highway projects, the instructors will utilize local talent and will also concentrate on problems peculiar to the particular job or site at hand.

★ This modern 35-foot classroom trailer, constructed in Los Angeles, has desk seats for 18 trainees, up-to-date audio-visual aids



★ Blackboard techniques will be emphasized at California's "trailer college"

DIGEST of Current Technical Literature

By John C. Black

How Houston freeway affects land values

To determine the effects of expressways such as that from the city of Houston to the Gulf of Mexico, on the values of adjacent real estate and also on property at a distance, the Texas State Highway Department, with the cooperation of U. S. Bureau of Public Roads, analyzed approximately 2300 bona fide sales along the Gulf Freeway and also in sections of Houston completely removed from the influence of this arterial. All sales for the areas studied in each of three periods —1939 to 1941, 1945 to 1946, and 1949 to 1951—were included. Results were reported by the State Highway Department under the title *A Study of Land Values and Land Use Along the Gulf Freeway.*

"The mechanics of analysis were consistent with sound technique. Adjustments were made for changes in the value of the dollar during the periods investigated; the value of improvements, adjusted for changes in the construction cost index, were filtered out of the aggregate values; and other refinements were made.

"The results of this study will amaze you: The percentage gain in market values in the primary areas immediately adjacent to the Gulf Freeway (where land increased from $0.65 to $1.44 per square foot) was more than twenty-four times as great as in the areas only indirectly accessible to the freeway, (where land increased from $0.57 to $0.60 per square foot), and approximately five times as great as in the areas completely removed from the expressway (where land increased from $0.98 to $1.23 per square foot). The percentage gain in market values in the secondary areas, close to the freeway but not right next to it (where land increased from $0.89 to $1.58 per square foot), was more than 15 times as great as the areas only indirectly accessible to the freeway (where land increased from $0.57 to $0.60 per square foot), and three times as great as the regions completely removed from the expressway (where land increased from $0.98 to $1.23 per square foot)."

From a paper by David R. Levin, presented at the 39th Annual Road School of Purdue University, and published in the PROCEEDINGS.

Mexicans add color to grace in new bridge design

A unique all-welded steel bridge spans the Rio Blanco near Vera Cruz, Mexico. It was planned by Mexican engineer Camilo Piccone from a conception of Dr. Thomas C. Kavanagh, American engineer, and erected by Estructuras, S. de R. L., Monterrey, Mexico. An ultra-modern basket-handle arch design gets heightened effect from the use of color—the curved ribs are orange and the horizontal tie-girders are cherry red. The bridge, which was opened in May, 1953, is 250 ft. long, carries three lanes of traffic.

From SOUTHWEST BUILDER AND CONTRACTOR, *October 9, 1953.*

Concrete mixes for small jobs

"For small jobs where time and personnel are not available to determine proportions in accordance with recommended procedure, mixes in Table A-2 will provide concrete that is amply strong and durable if the amount of water added at the mixer is never large enough to make the concrete overwet. These mixes have been predetermined in conformity with recommended procedure by assuming conditions applicable to the average small job, and for aggregate of average specific gravity. Three mixes are given for each maximum size of coarse aggregate. . . . Mix B for each size of coarse aggregate is intended for use as a starting mix. If this mix happens to be oversanded, change to mix C or, if it is undersanded, change to mix A. It should be noted that the mixes listed in the table apply where sand is dry. If sand is moist or wet, make the corrections in batch weight prescribed in the footnote." . . . "Concrete should slide, not run, off a shovel."

Concrete mixes: recommended general practice

The table and text of the foregoing item are from a comprehensive recommendation which is summarized as follows: "The proportioning of concrete, including mixes containing entrained air, is set forth in this recommended practice. Tables are provided which, along with laboratory tests on physical properties of fine and course aggregate, yield information rapidly for obtaining concrete proportions. Three examples are included in the design of air-entrained and non-air-entrained mixes which utilize the tables. Adjustment of aggregate proportions due to moisture present in aggregates is illustrated. Laboratory tests are given in the appendix and include those on physical properties of cement and aggregate."

Included in the tables are recommended sizes of aggregate for various type of construction, slumps for various types of construction, and mixing water requirements for different slumps.

From Proposed Recommended Practice for Selecting Proportions for Concrete, JOURNAL OF THE AMERICAN CONCRETE INSTITUTE, *October, 1953.*

TABLE A-2—CONCRETE MIXES FOR SMALL JOBS*

Maximum size of aggregate, inches	Mix designation	Approximate bags of cement per cu. yd. of concrete	Aggregate, lb. per 1-bag batch		
			Sand†		Gravel or crushed stone
			Air-entrained concrete‡	Concrete without air	
½	A	7.0	235	245	170
	B	6.9	225	235	190
	C	6.8	225	235	205
¾	A	6.6	225	235	225
	B	6.4	225	235	245
	C	6.3	215	225	265
1	A	6.4	225	235	245
	B	6.2	215	225	275
	C	6.1	205	215	290
1½	A	6.0	225	235	290
	B	5.8	215	225	320
	C	5.7	205	215	345
2	A	5.7	225	235	330
	B	5.6	215	225	360
	C	5.4	205	215	380

Note: Air-entrained concrete should be used in all structures which will be exposed to alternate cycles of freezing and thawing.

*May be used without adjustment.

†Weights are for dry sand. If damp sand is used, increase weight of sand 10 lb. for 1-bag batch, and if very wet sand is used add 20 lb. for 1-bag batch.

‡Air-entrained concrete can be obtained by the use of an air-entraining cement or by adding an air-entraining agent. If an agent is used, the amount recommended by the manufacturer will, in most cases, produce the desired air content.

Procedure: Select the proper maximum size of aggregate and then, using mix B, add just enough water to produce a sufficiently workable consistency. If the concrete appears to be undersanded use mix A, and if it appears to be oversanded use mix C.

Suggestion to protect bin stone from freezing

"Electric strap-on heating units," applied to the lower part of bins and thermostatically controlled to maintain temperatures slightly above freezing are recommended for efficiency, the entire bottom of the bin should be covered with a good heat insulator. Vertical walls need no cover. Such heating units are available for 110 or 220 volts in sizes of 1000, 2000, 3000, or 5000 watts each. There is no standby cost for current, since the units do not operate at temperatures above 35 deg. Number of units to install is determined by anticipated temperatures, but can be added to in case of unexpected lows.

Estimated cost for such an installation on a 10 x 10-ft. bin is—

Electric automatic contactor		$ 24
Thermostat		14
Three 5-kilowatt heating elements		60
Insulation		80
Materials		$178
For wiring installation	$ 50.00	
Applying insulation	50.00	
	$100.00	$100
Total cost of labor and materials		$278

Double this cost would be needed on a 14 x 14-ft. bin.

The author believes that this system will provide a net economy over the conventional use of steam or torches in many areas.

From an article by William J. Shore, in the June, 1953 issue of PIT AND QUARRY.

A study of median dividers in city streets

Should Richmond, Virginia install a median divider in improving its principal thoroughfare, Broad Street, and if so, what type or types should it use? The factors and reasoning that lead to a decision are outlined by the City's Traffic Engineer. Curb-to-curb width through the 6.2 miles of the improvement varied from 83 to 86 feet. A total of 29.4 miles of median strips in service on other main thoroughfares provided a basis of experience.

Major advantages recognized include:

1. Separation of opposing flows of traffic.
2. Prevention of midblock, U and left turns and reduction of rear-end and turning collisions.
3. Provision for pedestrian refuge areas on wide thoroughfares.
4. Provision for shadow areas for left-turning and straight-through cross-street vehicles.

Special local advantages include:

1. Beautification of residential areas.
2. Shade and health benefits.
3. Possible building of fine monuments on wide medians.
4. Provision of left-turning and deceleration lanes.
5. Better channelization of traffic and gradual aligning of vehicles at abrupt curves.

Special disadvantages are that:

1. Additional policing is required.
2. Trash accumulation occurs.
3. Maintenance of trees, grass, and shrubs is costly.
4. On abrupt median curve alignment, high accident rates occur.

Types considered were a raised curb with grass, shrubs and flowers; green or regular concrete; parking permitted in center — no median; painted white lines in center—no median; and installation of raised hinged metal plates covering underground pipes as a center median.

Finally, a six-foot concrete median not extending across crosswalk areas was selected because:

1. Minimum maintenance would be required.
2. Better traffic signalization, with dual overhead indications to each approach of traffic, could be maintained.
3. Heavy pedestrian movements occurred and were frequently trapped in the center of the intersection. With a six-foot median and a twelve-foot crosswalk, up to twenty-four pedestrians can be accommodated in the center area, assuming a three square-foot occupancy by each pedestrian.

The six-foot median is being extended approximately 1.6 miles.

Mid-block openings, or crossovers, in median strips are not provided in Richmond except at special locations such as fire and police stations and hospitals.

From an article by John T. Hanna, in TRAFFIC QUARTERLY *for October, 1953.*

Jet-piercing method for quarry blast holes

Jet-piercing, or "heat drilling," can be used economically on rocks which spall easily, such as quartzite, sandstone, granite and dolomite. Rocks like diabase trap and certain low-silica and coarse-grained granites, which tend to melt can not be worked to the same advantage.

The method developed, by Linde Air Products Company, is in use by Consolidated Quarries Corporation, Lithonia, Ga. Heat is provided by a hydrocarbon fuel such as kerosene or a low-viscosity fuel diesel oil and high-purity oxygen. Temperature of the flame is in excess of 4,000 deg. F, and its gas velocity is about 6,000 ft. per sec. At the burner head, the flame is surrounded by a circle of holes out of which the cooling water is forced under pressure.

Action of the flame causes a thin layer of rock to expand and break away from the base material. New rock is thus exposed and the process is repeated.

Equipment is simple and can be easily mounted on a churn-drill rig. Components are a long blowpipe, a burner head, some device for measuring depth of hole, necessary hoses for the three process fluids, and valves and gages for controlling the flow of fuel, oxygen and water to the burner head. Some ducting is also desirable to direct exhausted dust and steam away from the operator.

Deepest hole reported by Consolidated is 116 ft., but another quarry reports a 140-ft. maximum by this method. Fastest Consolidated rate—42 ft. per hour.

General results of jet-piercing at Consolidated Quarries:

Type of rock	fine-grained biotite granite gneiss
Hole diameter	6.5 in.
Average hole depth	77 ft.
Averave hole spacing	34 ft. apart 18 ft. back from quarry face
Average piercing speed	30 ft. per hour
Average breakage	50 tons per ft. of hole
Oxygen	378 cu. ft. per ft. of hole
Fuel used	kerosene
Fuel consumed	10.0 gal. per ft. of hole

From an article in CIVIL ENGINEERING *for September, 1953.*

How "skin mat" is built in Wisconsin

County road forces in Wisconsin, in 1952, placed about 300 miles of the type of surface described below.

"The typical light type road mix surfacing that we call skin mat is built after reinforcing the existing surface with an appropriate quantity of crushed gravel or stone, usually crusher run, graded from ¾-in. maximum size to dust, with about 50 per cent passing the No. 4 sieve. After the reinforcing layer of aggregate is placed, we scalp enough aggregate from the existing surface, about 1-in. depth, and road mix this material with SC material, usually SC-3. This thin mixed mat requires about 10,000 gals. of bituminous material for the conventional mat 20 to 22 ft. in width. Our 1952 cost for this type of work, exclusive of the cost of the aggregate scalped from the base, that is, the cost of bituminous material and mixing and placing, averaged $1,430 per mile."

From a paper by E. L. Roettiger, Wisconsin State Highway Engineer, presented before the 45th annual meeting of the Upper Peninsula Road Builders' Association, June 9, 1953.

(Continued on page 94)

Cleaver-Brooks EQUIPMENT
for Steam . . . Hot Water . . . Heat

SELF-CONTAINED STEAM BOILERS

125 HP Model LFM-12 (trailer mounted)

MOBILE — PORTABLE

Portable steam for Asphalt, Ready or Hot-Mix Plants, Rock Asphalt Heating, Aggregate Drying Storage & Tank-Car Heating, Pile Driving, Winter Concrete Curing. Trailer-mounted for easy towing. Skid-mounted for installation on your truck or trailer. A.S.M.E. Code constructed. All-season usefulness, all-weather protected.

SPECIFICATIONS

MODEL	LFM-8	LFM-12
Approx. Boiler horsepower	80	125
Approx. rated capacity lbs. of steam per hour (212° F)	2760	4300
Weight of normal water capacity lbs.	3770	4860
Capacity of Fuel Oil Tank, gals.	85	115
Capacity of Gasoline Tank, gals.	5	30
SKID MOUNTED		
Overall length	14' 8"	16' 4"
Overall width	5' 6"	6' 0"
Overall height	6' 6"	6' 10"
Approx. shipping weight, lbs.	10,000	14,410

TRAILER MOUNTED (dual wheels)

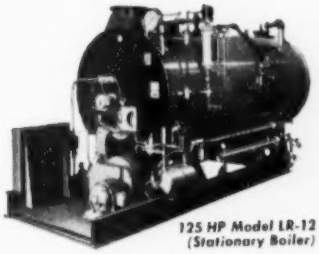
	LFM-8	LFM-12
Overall length	17' 9"	19' 10"
Overall width	8' 0"	7' 11"
Overall height	7' 9"	8' 6"

TRAILER MOUNTED (tandem wheels)

	LFM-8	LFM-12
Overall length	17' 9"	19' 10"
Overall width	7' 0"	7' 6"
Overall height	7' 9"	8' 5"
Approx. shipping weight, lbs.	14,000	18,000

STATIONARY

Shipped as a complete, ready-to-operate self-contained unit. For Asphalt Plants, Oil Bulk Stations, Ready-Mix Concrete and Concrete Block and Cast Products Curing Plants. Finished and tested under actual loads. Approved safety devices. Designed to A.S.M.E. Code. Hartford Insurance inspected and approved. Fast steaming, 80% efficiency —full load down to 30% rating when firing with oil. Low-fire start saves fuel. Burns oil, gas or combination oil or gas. Sizes: 15 to 500 HP; 15 to 250 psi.



125 HP Model LR-12 (Stationary Boiler)

SPECIFICATIONS

Boiler Horsepower—125

Lbs. Steam per hour from and at 212° F.—4,300

BTU Output, 1,000 per hour —4,180

EDR Steam Gross—17,370

EDR Steam Net, HP and A.C.C.—17,300

Unit has self-contained fuel and gasoline tanks.

PORTABLE PUMPING BOOSTER

Withdraws pumpable bitumens from tank cars. Heats by direct firing, recirculates, then delivers directly to distributor. Raises temperature 50° F. per hour. Larger, electric motor-driven unit available for stationary use.

SPECIFICATIONS

NO. 1A PUMPING BOOSTER
Operating burner at full cap. and pumping material:

Approx. 300 G.P.M. temperature rise	25- 35° F.
Approx. 180 G.P.M. temperature rise	45- 55° F.
Approx. 100 G.P.M. temperature rise	85- 95° F.
Approx. 50 G.P.M. temperature rise	170-180° F.

Heats 10,000 gal. car 35-45° F. per hour.

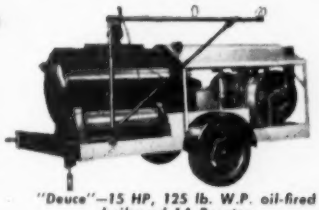
NO. 2AA PUMPING BOOSTER
Operating burner at full cap. and pumping material:

Approx. 350 G.P.M. temperature rise	45- 55° F.
Approx. 203 G.P.M. temperature rise	80- 90° F.
Approx. 112 G.P.M. temperature rise	110-120° F.
Approx. 60 G.P.M. temperature rise	200-210° F.

Heats 10,000-gal. car 55-65° F. per hour.

"DEUCE" Combination TANK-CAR HEATER AND PUMPING BOOSTER

"Deuce" pre-heats to pumpable consistency, circulates and heats to application temperature — then pumps and loads distributor. A.S.M.E. Code constructed. Four-pass boiler, equipped with condensate pump, is mounted on same frame with direct-fired booster and asphalt pump.



"Deuce"—15 HP, 125 lb. W.P. oil-fired boiler ad 1A Booster

Operating Burner at Full Capacity and Pumping Materials

Approx. 300 G.P.M. Temperature rise	25- 35° F.
Approx. 180 G.P.M. Temperature rise	45- 55° F.
Approx. 100 G.P.M. Temperature rise	85- 95° F.
Approx. 50 G.P.M. Temperature rise	170-180° F.

Heats 10,000 gallon car 35-45° F. per hour.

SPECIFICATIONS

	Skid	Trailer
Overall length, in.	159	185
Overall width, in.	66	81
Overall height, in.	71	90
Shipping weight, lbs.	6350	7080

Available in 2 sizes, skid-mounted

PEAK-TEMP OIL BOOSTER

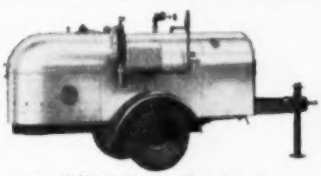
Heavy-duty, fully automatic booster uses high-flash-point oil as heat transfer medium to raise and maintain bituminous and heavy viscous materials to application temperatures. Fired by pressure-atomizing oil burner. Self-contained—ready for service line hookup.

SPECIFICATIONS

	Model 1201	Model 1801
Overall length, in.	145	169
Overall width, in.	66	66
Overall height, in.	78	96
Shipping weight, lbs. (approx.)	6100	7000
Burner Capacity (Maximum)	12 gph	18 gph

MOBILE TANK-CAR HEATER

Compact oil-fired boiler for operation at 125 lbs. W.P. Four-pass, down-draft, A.S.M.E. Code constructed. Uses fuel oil to and including Commercial No. 2. Has other year-round applications: Steam cleaning, culvert thawing, etc.



Available in Two or Three Car Sizes

SPECIFICATIONS

	Trailer	Skid
TWO-CAR HEATER, 28 BHP		
Overall length, in.	162	126
Overall width, in.	60¾	36½
Overall height, in.	69	53¼
Shipping weight, lbs.	4000	3900
THREE-CAR HEATER, 42 BHP		
Overall length, in.	164	127½
Overall width, in.	67	42
Overall height, in.	79½	59¼
Shipping weight, lbs.	4800	4500

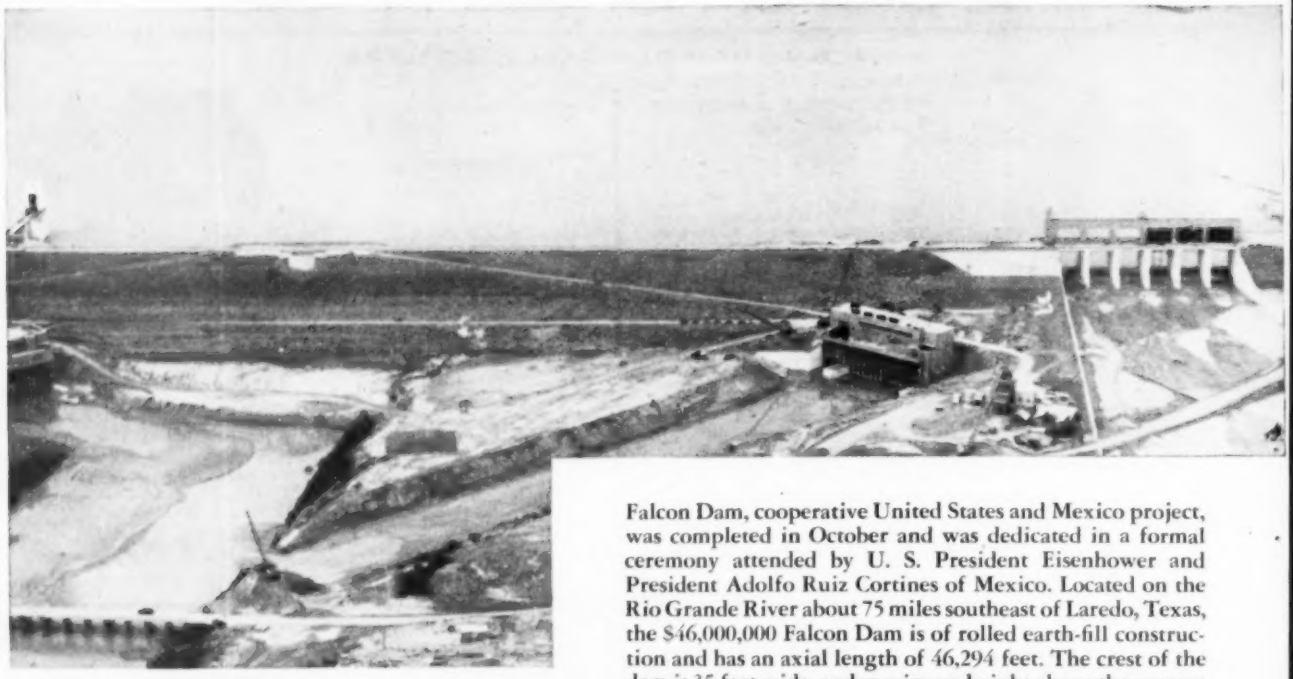
Write for Catalogs and Complete Details

CLEAVER-BROOKS COMPANY

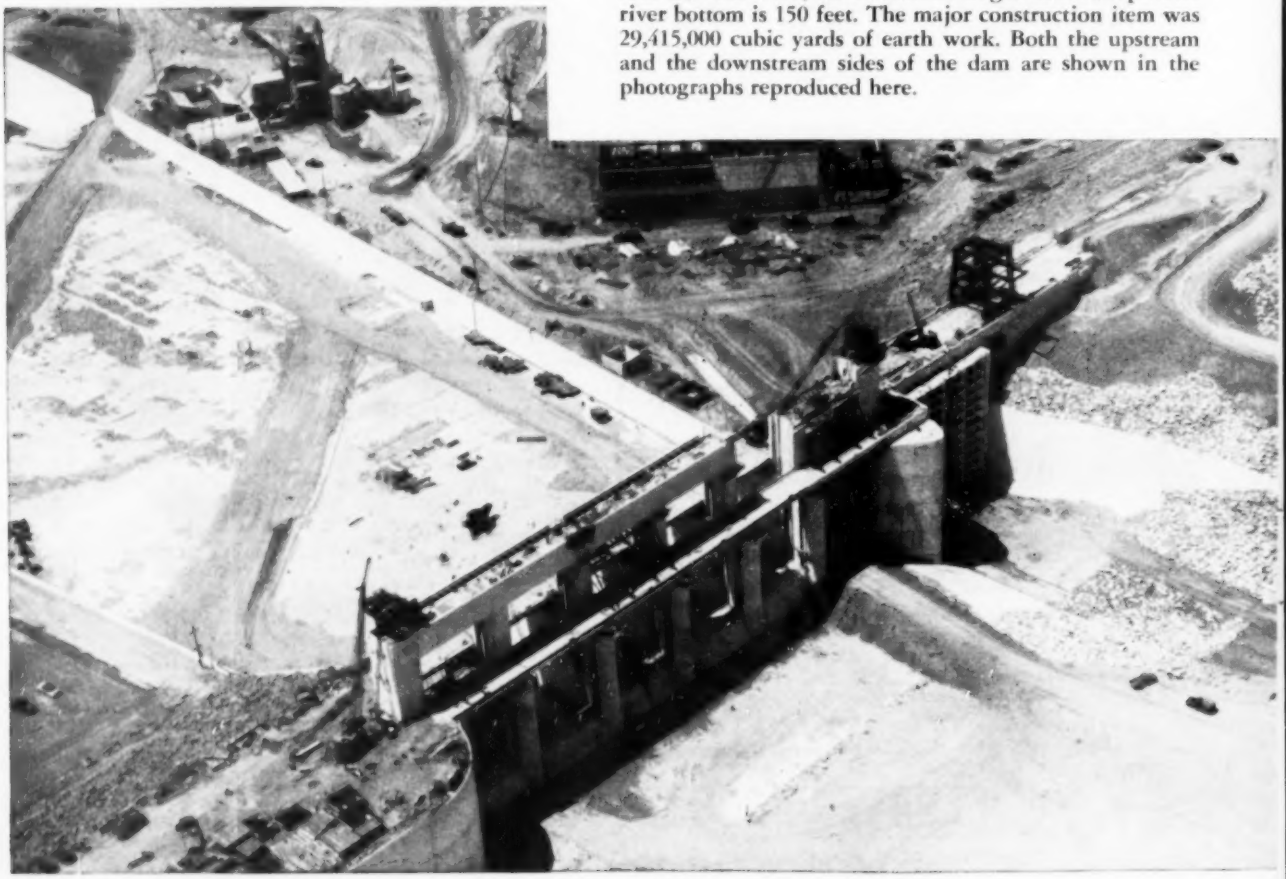
DEPT. M, 395 E. KEEFE AVE.
MILWAUKEE 12, WISCONSIN

Pioneers and originators of self contained boilers, Tank-Car Heaters and Bituminous Boosters

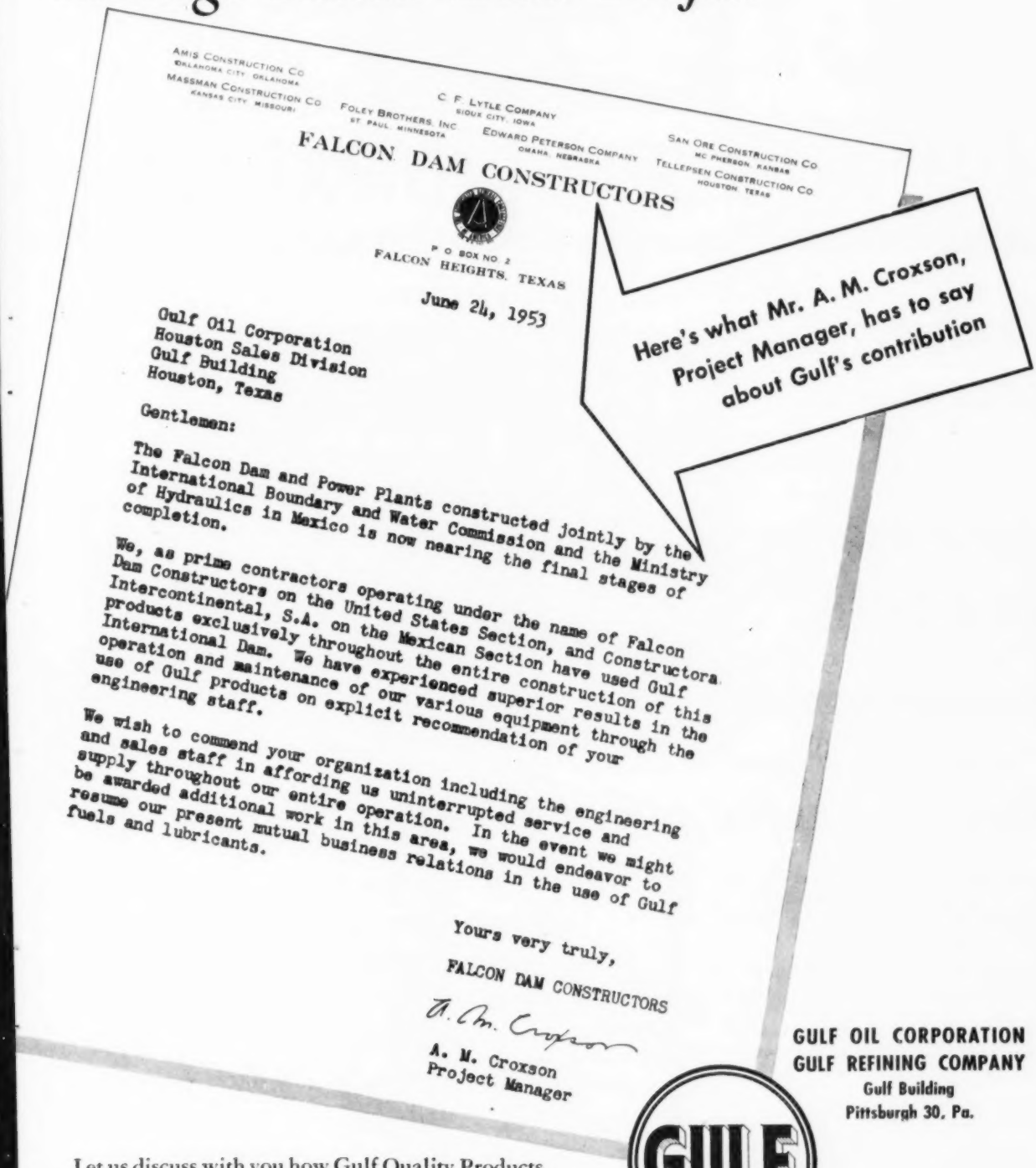
GULF PRODUCTS *and* FINE SERVICE



Falcon Dam, cooperative United States and Mexico project, was completed in October and was dedicated in a formal ceremony attended by U. S. President Eisenhower and President Adolfo Ruiz Cortines of Mexico. Located on the Rio Grande River about 75 miles southeast of Laredo, Texas, the $46,000,000 Falcon Dam is of rolled earth-fill construction and has an axial length of 46,294 feet. The crest of the dam is 35 feet wide, and maximum height above the present river bottom is 150 feet. The major construction item was 29,415,000 cubic yards of earth work. Both the upstream and the downstream sides of the dam are shown in the photographs reproduced here.



keep equipment rolling on huge Falcon Dam Project



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C. F. LYTLE COMPANY
SIOUX CITY, IOWA
EDWARD PETERSON COMPANY
OMAHA, NEBRASKA
SAN ORE CONSTRUCTION CO
MC PHERSON, KANSAS
TELLEPSEN CONSTRUCTION CO
HOUSTON, TEXAS

FALCON DAM CONSTRUCTORS

P. O. BOX NO. 2
FALCON HEIGHTS, TEXAS

June 24, 1953

Gulf Oil Corporation
Houston Sales Division
Gulf Building
Houston, Texas

Gentlemen:

The Falcon Dam and Power Plants constructed jointly by the International Boundary and Water Commission and the Ministry of Hydraulics in Mexico is now nearing the final stages of completion.

We, as prime contractors operating under the name of Falcon Dam Constructors on the United States Section, and Constructora Intercontinental, S.A. on the Mexican Section have used Gulf products exclusively throughout the entire construction of this International Dam. We have experienced superior results in the operation and maintenance of our various equipment through the use of Gulf products on explicit recommendation of your engineering staff.

We wish to commend your organization including the engineering and sales staff in affording us uninterrupted service and supply throughout our entire operation. In the event we might be awarded additional work in this area, we would endeavor to resume our present mutual business relations in the use of Gulf fuels and lubricants.

Yours very truly,

FALCON DAM CONSTRUCTORS

A. M. Croxson

A. M. Croxson
Project Manager

Here's what Mr. A. M. Croxson, Project Manager, has to say about Gulf's contribution

GULF OIL CORPORATION
GULF REFINING COMPANY
Gulf Building
Pittsburgh 30, Pa.

GULF

Let us discuss with you how Gulf Quality Products and Fine Service can help you on your next job. They are available to you through more than 1400 warehouses. Write, wire or phone your nearest Gulf Office.

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KEEP IT HANDY—

USE IT OFTEN—

Your most useful source of Buying Information

- This book saves you cabinet and floor space and the secretarial time that would otherwise be spent in classifying and filing individual manufacturers' catalogs.
- It saves you, too, the time and trouble of writing to manufacturers for the information you need. Here are enough facts to enable you to study the product that interests you and to decide whether to call your local dealer or distributor for decisive action.
- When you want information quickly, on a certain class of product or on the product of a specific manufacturer, turn first to the index for the name or trade name of the product in which you are interested and then to the manufacturers' catalog which is arranged in alphabetical order by manufacturers' name.

When you are in the market for new construction equipment, materials or supplies, turn to Gillette's Heavy Construction Prefiled Catalogs for information on what to buy and from whom. Here's the swift, economical and satisfying way to make your pre-purchase studies. In this single volume many of America's leading manufacturers of these products have placed their catalogs, many of them specially designed for your convenience—"boiled down" to save you time and energy.

CATALOGS...

the way you asked for them—PREFILED

Contractors, engineers, public officials PREFER receiving manufacturers' catalogs PREFILED rather than to have individual catalogs sent by manufacturers. Individual catalogs are usually mislaid or thrown away.

The manufacturers listed below have followed your wishes—and at considerable expense. Through the PREFILED method they have supplied you with catalog information on their products in the current 1953 edition of Gillette's Heavy Construction Catalog File (See opposite page). Be sure to take advantage of this information. Use the Gillette Catalog File all the time. Keep it handy every day—every week. Use it often. Consult the Catalog File when you want information before buying new equipment, materials or supplies.

Here is the list of manufacturers who have supplied you with buying information on their products.

Adams Manufacturing Co., J. D.
Allis-Chalmers Manufacturing Co.
All Purpose Spreader Company
American Air Filter Co.
American Bosch Corporation
American-Coleman Company
American Manganese Steel Division
American Marietta Co.
American Steel & Wire
American Tractor Equipment Corp.
Anthony Company
Armco Drainage & Metal Products, Inc.
Arrow Manufacturing Company
Austin-Western Company

Baldwin-Lima-Hamilton Corp.
Badger Machine Co.
C. L. Ballard
Beardsley and Piper
Bicknell Manufacturing Company
Briscoe & Son, E. V.
Bros Boiler & Mfg. Co., Wm.
Buda Company, The
Buffalo-Springfield Roller Co., The
Butler Bin Company

Carey Manufacturing Co., The Philip
Carson Company, H. Y.
Carter Co., Ralph R.
C. H. & E. Manufacturing Co., Inc.
Chausse Manufacturing Co., Inc.
Cleaver-Brooks Company
Cleveland Formgrader Co., The
Cleveland Frog and Crossing Co.
Cleveland Trencher Company, The
Clipper Manufacturing Co.
Clyde Iron Works
Concrete Surfacing Machine Co.
Crockett Brothers
Cummer & Son Company, The F. D.
Cummins Engine Company, Inc.

Davenport Besler Corporation
Detroit Diesel Engine Division
Dixie Tally-Ho, Inc.
Dorsey Trailers

Eagle Crusher Co., Inc.
Electric Tamper & Equipment Co.
Erie Steel Construction Company

Falker Manufacturing Co.
Fiske Brothers Refining Co.
Flexible Road Joint Machine Co., The
Flintkote Company, The
Foundation Equipment Corporation
Fraco Manufacturing Co.

Galion Allsteel Body Company
Galion Iron Works & Mfg. Company
Gar Wood Industries, Inc.
General Excavator Co.
General Motors Corporation
Gledhill Road Machinery Co., The
Goodall Rubber Company
Gradall Division, Warner & Swasey
Haiss Mfg. Co., Inc., Geo.
H. & L. Tooth Co.
Hammermills, Inc.
Harnischfeger Corporation
Hauck Manufacturing Co.
Heltzel Steel Form & Iron Co.
Hercules Motors Corporation
Herman Nelson
Highway Equipment Co., Inc.
Hose Accessories Company
Hough Co., The Frank G.
Huber Manufacturing Co., The

Jackson Vibrators, Inc.
Johnston and Jennings Co.
Joint Equipment Company, Inc.
Joy Manufacturing Company

Keystone Asphalt Products Company
Kiesler Co., Jos. E.

La Crosse Trailer Corporation
Leece-Neville Co., The
Le Roi Company
Lincoln Electric Company, The
Littleford Bros., Inc.
Lubriplate Division

Marlow Pumps
Master Vibrator Company
Michigan Power Shovel Company
Minneapolis-Moline

Naugatuck Chemical Division
Noble Company

Oliver Corporation, The
Omaha Standard
Onan, D. W. & Sons, Inc.
Osgood-General
Ottawa Steel Products, Inc.
Owen Bucket Co., The

Pacific Car and Foundry Company
Page Engineering Company
Philadelphia Textile Finishers, Inc.
Phoenix Products Co.
Pioneer Engineering Works
Pitman Manufacturing Company
Porter, Inc., H. K.

Republic Steel Corporation
Riddell Corp., W. A.
Rogers Brothers Corporation
St. Paul Hydraulic Hoist
Salem Tool Company, The
Sauerman Bros., Inc.
Schramm, Inc.
Service Supply Corporation
Serviceised Products Corp.
Shunk Manufacturing Company
Standard Steel Corporation
Sterling Engineering & Mfg. Co.
Stow Manufacturing Company
Sumner Equipment Limited
Super-Compactors, Inc.
Symons Clamp & Manufacturing Co.
Syntron Company

Talbert Construction Equip. Co.
Tarrant Mfg. Co.
Thurman Machine Co., The
Timken Roller Bearing Co., The
Titan Chain Saws, Inc.
Transport Trailers, Inc.
Tuthill Spring Company

Universal Engineering Corp.

Vibro-Plus Products, Inc.
Vulcan Tool Manufacturing Co

Warner & Swasey Co.
Waterloo Foundry Co., Inc.
Waukesha Motor Company
Wellman Engineering Co., The
Whitestown Trencher Co., Inc.
Wico Electric Company
Williams Form Engineering Corp.
Winter-Weiss Co., The
Wyoming Valley Equipment Co., Inc.
Yaun Manufacturing Co., Inc.

SYNTRON

PORTABLE POWER TOOLS
for Construction and Maintenance

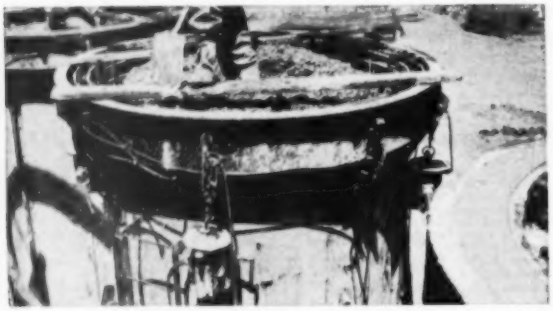
GASOLINE HAMMER
ROCK DRILLS and
PAVING BREAKERS

Fast — Efficient
Economical

Asphalt paving is dug up quickly and easily with Syntron Gasoline Hammer.

Self-contained Gasoline Hammer Rock Drills and Paving Breakers that deliver over 2000 powerful blows per minute. No air compressor or accessories. One man operation. Cutting asphalt—digging clay, shale and frozen ground—tamping backfill.

MASS AND FORM CONCRETE VIBRATORS



Vibrating Huge Sewer Pipe Form with Syntron Concrete Vibrators.

Wall Form Vibrators which assure uniform compacting and settling on countless construction jobs. Models available for light, medium or heavy form work. Motor driven, flexible shaft types for large vibration also available.

For Complete Information—Write for
Free Catalog Material

SYNTRON COMPANY

384 Lexington Ave.
Homer City, Pa.

Technical Digest

(Continued from page 88)

Soil classification without analysis may mislead

A novel test was carried out in connection with a revision of standard specifications, particularly DIN 1779 and 4022, dealing with nomenclature and classification of soils in relation to foundations. The problem was to find in what extent soils can be classified without a formal mechanical analysis to determine the actual grading and clay content, etc. The basis was the Atterberg classification into the groups: gravel (2 to 20 mm.); sand (0.2 to 2 mm.); fine sand (20 to 200 μ) each with three subdivisions; and fine clay (under 2 μ). The test allowed only the estimation of the "feel," and the use of the naked eye (or with the help of a hand lens): 30 samples of very varied types of soil were used, the mechanical analysis of which had been determined but kept secret, and eight experienced committee members (engineers, geologists, soil specialists, etc.) examined these samples separately to decide their general classification and to report strong or weak components. From a total of 209 determinations, 102 were wrong; 77 correct, and 30 approximately right only. There was a general tendency to overestimate the coarse sizes, and to find "fine clay" where there was only fine silt. A few samples were recognized from their petrographic character. Evidently separations within the range 0.02 to 1 mm., and the customary divisions at 200 μ and 20 μ cannot be made with any reasonable accuracy by such simple methods.

From HIGHWAY RESEARCH ABSTRACTS, *July 1953* [*W. Dienemann. Bautech., 1951, 28 (3) 58-61. Building Science Abstracts, Vol. XXIV, No. 4, u. 112, April, 1951.*]

Sand compaction cost $0.10 per cu. ft. by vibro method

Vibrating equipment in the phosphate plant of International Mineral & Chemical Corp. to be built near Bartow, Fla., required that the entire plant area be compacted to prevent damaging settlements. The formation consisted of a layer of loose, windblown sand from 10 to 15 ft. deep, resting on a sand-clay-phosphate conglomerate of high bearing strength for raft foundations or spread footings on the sand above, but of inadequate resistance to pile penetration.

Relative density of the sand layer averaged 33%, increasing from 30% near the top to 47% at 12 ft. deep. Seventy per cent was set as the criterion for adequate compaction. Weight of original sand ranged from

90 to 110 lbs. per cu. ft. Minimum after compaction was set at 103 lbs. It is noted that surface settlements may occur up to approximately 1 in. of depth of natural sand deposit.

Comparison of compaction methods by the driving of short, stubby piles, blasting, rubber tired rollers, vibrating plates, and vibroflotation indicated the latter as most effective and economical. Approximately 156,000 sq. ft. of ground area were compacted to an average depth of 12 ft., at a cost of approximately $0.10 per cu. ft. Vibration points were spaced 7 ft. 6 in. on a triangular pattern. Compaction proceeded at an average rate of 1,400 sq. ft. per day, requiring 25 to 30 penetrations of the vibroflot during each 8-hr. shift. This was the first large scale application of the vibroflotation method in the United States, although it has had previous extensive use in Europe.

The report here quoted deals chiefly with field and laboratory tests. Design curves for compaction of clean, uniform sands similar to those at Bartow were developed.*

From a paper by Elio D'Appolonia, Callix E. Miller, Jr., and Thomas E. Ware in PRECEEDINGS *of American Society of Civil Engineers, July, 1953.*

Bulk cement for small and scattered jobs

An English equipment development which is said to afford eocnomies on many small and medium sized concrete jobs consists primarily of two truck-mounted spherical, aluminum alloy, cement containers (combined capacity 7 tons); a 10-ton silo of laminated wood, designed for portability and handling without special equipment; and a semi-automatic batch-weighing and delivery outfit. Combined weight of silo and weighing and delivery equipment is about 1,250 lbs.

The cement transport unit provides air-tight protection for the contents at all times, including both loading and discharge periods. The spheres load from the top and discharge from the bottom under air pressure supplied by a compressor on the truck. Transfer is direct from sphere to silo, with no other equipment necessary. Delivery can be made to a maximum height of 40 ft. The compressor has been especially designed to keep air free from oil.

The batching operation begins automatically when mixer hopper is moved into position at the silo. Cutoff is automatic when correct amount has been delivered. Setting may be made at any desired amount not exceeding 200 lbs. Under normal conditions one "cement tanker" is enough to serve several silos.

From an article in the September, 1953 issue of ROADS AND ROAD CONSTRUCTION, *London.*

Bulletin on short-cut for soil-cement tests

A 12-page booklet, entitled "Short-Cut Soil-Cement Testing Procedures for Sandy Soils," has been published by the Portland Cement Association. It explains procedures which will greatly reduce the amount of work required in testing soils for soil-cement construction.

Scientific testing and control methods have been developed by the PCA since 1935, insuring satisfactory performance of this type of construction for light traffic roads and streets, airports and parking areas.

Included in the booklet are 10 charts on cement content, moisture content, and density of soil-cement. These charts are so planned that when correctly used they will reduce the laboratory technician's work by showing the amounts of materials to use for individual tests. Use of the charts does not involve new tests or additional equipment.

The only laboratory tests required in following the new "short-cut" test procedures are a grain size analysis, moisture-density test, and compressive strength tests. Relatively small soil samples are needed, and except for results of the 7-day compressive strength tests, all tests can be completed in one day.

Individual copies of "Short-Cut Soil-Cement Testing Procedures for Sandy Soils" are available free in the United States and Canada on request to the Portland Cement Association, 33 W. Grand Avenue, Chicago 10.

*A general description of this job, without the above data, was published in *Roads and Streets* for May, 1953.

the FRINK
PUSHES EASIER

Saves TIME and MONEY

The Frink V-Type Sno-Plows give cleaner and safer plowing because there is no side thrust. The unique feature that prevents this is that the heel adjusting chains are so arranged that the weight of the snow, as it is carried up and out, is transferred through these chains to the lifting device assembly and directly to the front wheels.

Another factor is the basic contour of the Frink moldboard, which is parallel curved and flared in such a way that the snow is raised up above the adjacent snow and then flows outward, thus eliminating a pile-up at the front of the plow.

The combination of these two factors makes the Sno-Plow easier to push and gives a cleaner plowing result. Only Frink Sno-Plows have this patented feature.

Frink Reversible Type, One-Way Type, V-Type Sno-Plows and the Frink Roto-Broom are interchangeable on the same truck attachment.

For further details on this Sno-Plow write for catalog to nearest address, Box RS5311

FRINK SNO-PLOWS

FRINK SNO-PLOWS, INC., CLAYTON, NEW YORK
DAVENPORT-BESLER CORP., DAVENPORT, IOWA
FRINK SNO-PLOWS of CANADA, LTD., TORONTO, ONT.

Wanted: Civil Engineers

A noteworthy program of recruiting engineering students among high-school lads is being tried in Michigan with contractor association, college and highway department cooperation.

By C. J. Carroll
Executive Secretary
Michigan Road Builders Association

★ The 30-man "class" of future engineers at Jackson's Hole, Wyoming, last summer

THESE days it is a pretty common thing to hear industrial heads and businessmen moan about the shortage of trained personnel. But when they actually coerce their efforts to do something about that shortage, it makes news. At least, that is what is happening to a program started late in 1952 through the cooperative efforts of the Michigan Road Builders Association, the Michigan Highway Department, and the University of Michigan.

For several years, particularly since the close of World War II, the serious shortage of civil engineers and trained engineer aides available for highway work has caused complaint and even alarm. Causes of this condition are various, with relatively low salaries getting primary blame.

Actually, the decline in the number of engineering students started before the war. Today's youth are hesitant to select a life work that calls for a long schooling period when they live under the constant threat of prolonged military service; and whether we like it or not, they are money conscious.

There are also other factors. About five years ago the Federal Labor Department sent out a report to all high schools stating there would be a surplus of engineers in this country by 1954. The report was intended as an aid to vocational guidance groups assisting students in selecting their proper fields, and when the error was

THURMAN
PORTABLE
TRUCK SCALE
SAVE COSTS by eliminating concrete pits for your scales. The Thurman Portable needs no pit, is accurate on any flat terrain. When moving to new location, merely remove 6 bolts that hold side arms. Then, lift scale as a unit. Once positioned, it can be ready for use in minutes. Steel deck is cushioned to absorb the shock of moving vehicles and protect vital parts. Weighbeam is chrome-plated. Other essential parts are electro-plated against weathering.
SAVE on Weighing Costs
NO PIT NEEDED
above: in use at Fisher Bros. Const. Co. Farmington, Minn.
THURMAN
Machine Co.
(Scale Division)
156 N. 5th Street
Columbus, Ohio
Est. 1918
Dept.
Capacities: 20, 25 and 30 Ton
Platform Lengths: 18, 22, 24 and 30 ft.

CUT BRUSHCUTTING COSTS UP TO 83%!

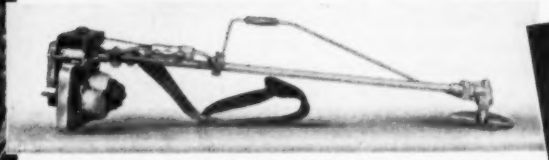
POWER-DRIVEN BRUSHMASTER

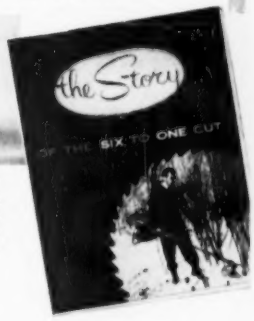
amazing, one-man-operated brushcutting machine is

☆SAFE! ☆EFFICIENT! ☆ECONOMICAL! ☆FAST!

colorful FREE BOOKLET SHOWS HOW

the "machine magic" of BRUSHMASTER can effect important brush clearance savings for your company. SEND TODAY!





It's one man . . . instead of six . . . when Brushmaster takes the field! Count up the savings! Quickly, easily the circular saw blade cuts through matted grass, vines, briars, . . . even saplings to 4" in diameter! SAFE . . . operator cannot come in contact with blade! MOBILE . . . operates overhead, close to ground, right to left and back again! Vibration-free, clutch controlled, positive drive.

BRUSHMASTER SAW, INC.
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discovered the statement was immediately retracted. How many students were frightened away from the engineering field by the report is guesswork, but it undoubtedly contributed to the present shortage.

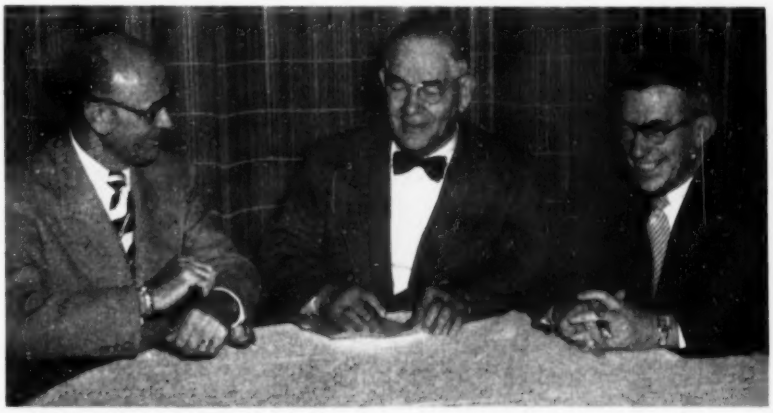
Probably the most potent factor creating the shortage has been the accelerated boom in street and highway construction, industrial expansion and internal improvement.

Plan Started

Early last fall, when George M. Foster, Chief Deputy Commissioner of the Michigan Highway Department, and Chairman of the Manpower Committee of the Michigan Engineering Society, placed a personal call to Earnest Boyce, Chairman of the Department of Civil Engineering, University of Michigan, his needs were immediate.

Actually, the Highway Department was already carrying out one plan to enlist trained help, but it needed a supplement. Back in 1949, with the cooperation of Civil Service, the Highway Career Plan was instigated. Under this plan college students who successfully pass the Civil Service examination for Engineering Aides B are offered summer employment with the Highway Department at a starting salary of $236 per month, and increases in successive seasons.

Engineering graduates (whether they have taken the summer training or not) are eligible for examination for Engineering Trainee 1; in which position they have a work period of seven weeks in each of the Department's seven divisions. At the end of this period they are eligible to take the examination for Engineering Trainee 2 at a starting salary of $395 per month, with step raises over a four-year period advancing them to $460 per month. Beyond this, the effort is made to place each man in the type of work and in the division of his choice.



★ Jointly responsible for the Michigan recruiting program: George M. Foster, Chief Deputy Commissioner, Michigan Highway Department; Earnest Boyce, Chairman Department of Civil Engineering, University of Michigan; C. J. Carroll, Executive Secretary, Michigan Road Builders Association

However, this program was not providing sufficient trained highway personnel to meet the demand, and it was evident that something more was needed.

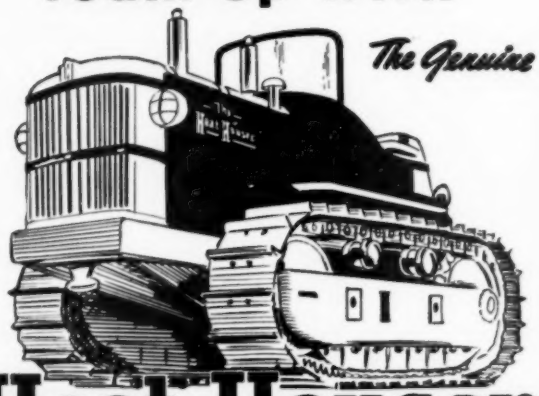
Foster's call resulted in a meeting in Boyce's office which was to give birth to a program specifically de-

(Continued on page 106)

DON'T LET "WEATHER" CUT EFFICIENCY

team up with

The Genuine



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INDUSTRIAL

Why tie up your equipment and reduce the efficiency of the operator during cold weather? The Genuine HEAT-HOUSER manufactured from HEAVY DUTY, water resistant canvas is designed for maximum operator room and vision. Compact, one piece easily installed on most industrial type tractors; it will protect equipment and operator during those cold working days ahead. WRITE FOR COMPLETE DETAILS. THE COST IS LOW AND THE SERVICE HIGH . . . SPECIFY THE GENUINE HEAT-HOUSER . . . KEEP WARM WHILE YOU WORK.

SOLD THROUGH RECOGNIZED DISTRIBUTORS OF INDUSTRIAL EQUIPMENT

FORT DODGE TENT AND AWNING COMPANY

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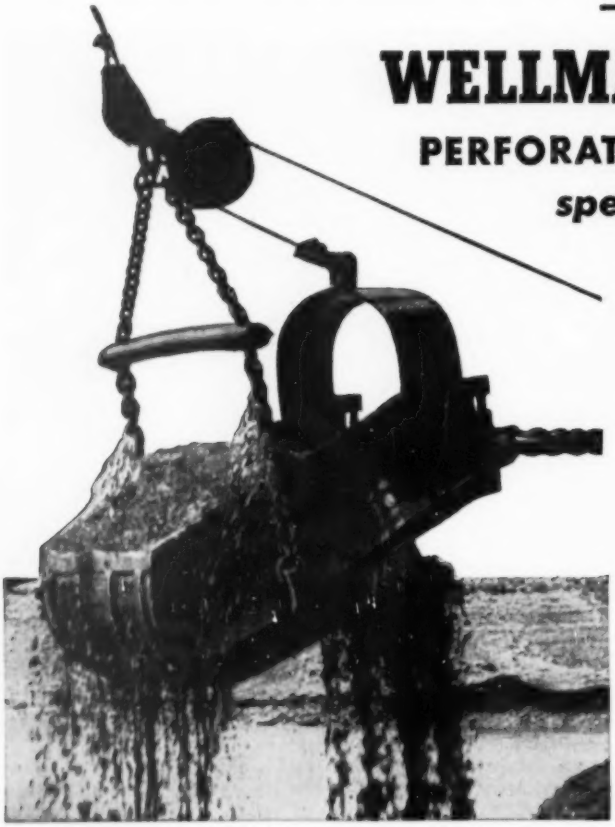

WELLMAN *Williams Type*

PERFORATED DRAGLINE BUCKET

speeds the wet jobs

• You get big loads fast with this Wellman Perforated Dragline Bucket because excess water goes out while gravel stays in on jobs such as illustrated.

Built of special alloy steel—all welded for strength plus light weight. You can work faster with less maintenance with Wellman dragline buckets.

Want Facts?

Write for free descriptive bulletins.

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THE WELLMAN ENGINEERING COMPANY

7000 Central Avenue • Cleveland 4, Ohio

Highly Integrated Methods Speed Snow Removal in Milwaukee

Outlining inter-departmental cooperation, methods and equipment used by this city which has done an excellent job of winter traffic management. Downtown snow clearing separately managed.

By William J. Rheinfrank

Superintendent, Bureau of Street Sanitation
City of Milwaukee, Wisconsin

IN the City of Milwaukee there are 922.1 miles of street which require plowing of which 350 miles are fire runs, bus lines, street car lines or main traffic arteries. The City is divided into forty routes or areas for snow plowing operations.

Snow removal involves several bureaus in the Department of Public Works, the one most directly responsible being the Bureau of Street Sanitation. The weather conditions together with Weather Bureau forecasts are closely checked night and day, in order to determine working plans. In the case of a light snow, or freezing conditions, from 60 to 80 dump trucks and sand spreaders are used to sand the main streets and hills in order that motorists may drive safely. There are 916 sand boxes placed at intersections and top and bottom of hills which are kept filled with salted sand and a shovel, sand which can be spread quickly by any citizen or City employee. These boxes are placed before the winter season, kept filled all winter and removed in the spring for renovating.

Salted Sand Used

There are five sand-hopper stations and two end loader stations each serving a designated area. These distribution points enable the bureau to spread salted sand and quickly combat the emergency. During 1952, 23,318 tons of salted sand were used costing $103,679.

The Commissioner of Public Works gives the order for snow plowing. When an alert is given the Bureau of Street Sanitation, supervisors and employees of the Bureau of Municipal Equipment and other bureaus are given orders to report for work. This is done by telephone, or by the Police Department where the employee has no phone. The Snow Headquarters is in Room 301 City Hall, where the Bureau Superintendent, and three assistants remain on duty, receiving reports of the finishing of routes, and working closely with the Dispatcher's office on the re-assignment of equipment to secondary routes, etc.

Records are kept of each piece of equipment, the route it is assigned to, operator's name, beginning time. Twenty field supervisors report to the Snow Headquarters for route assignments and maps. They each take two routes. 11:00 P.M. is customarily the hour that plowing operations begin. The supervisors report in each hour by telephone. A typical report would be: "Jones speaking, 1:30 A.M. Route 22 finished to line 34." When the primary routes are finished, plows are

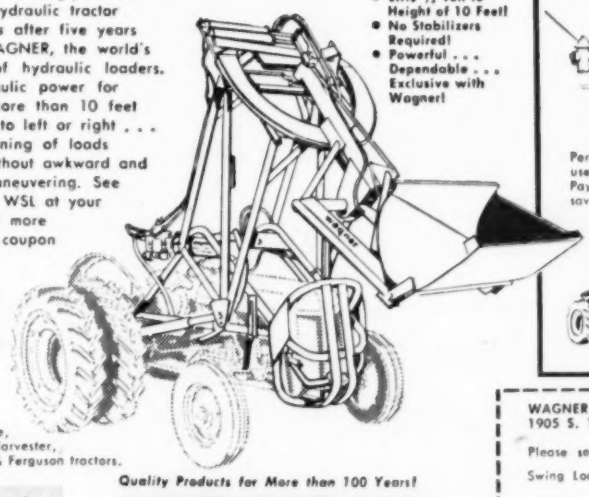
Another first from waqner

WSL SWING LOADER

Sensationally new . . . excitingly different . . . the ultimate in hydraulic tractor loaders . . . now yours after five years of development by WAGNER, the world's largest manufacturer of hydraulic loaders. Here is smooth, hydraulic power for lifting to heights of more than 10 feet . . . for swinging 90° to left or right . . . for dumping and crowning of loads onto trucks . . . all without awkward and troublesome tractor maneuvering. See the amazing WAGNER WSL at your first opportunity or for more information fill in the coupon and mail now. Be among the first to save considerable time and money with WAGNER . . . and the finest tractor loader on the market!

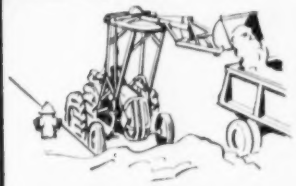
Currently available for all popular models of Allis-Chalmers, J. I. Case, John Deere, International Harvester, Minn.-Moline, Oliver, Ford & Ferguson tractors.

- 180° Lateral Swing Without Moving Tractor!
- Lifts ½ Ton to Height of 10 Feet!
- No Stabilizers Required!
- Powerful . . . Dependable . . . Exclusive with Wagner!



IDEAL FOR SNOW REMOVAL!

Special offset bucket permits close curb cleaning. Lifts, dumps and crowns loads onto truck without maneuvering tractor.



MANY OTHER USES!

Perfect for sand, gravel and quarry use and a natural for coal yards. Pays for itself in time and effort savings.

Most Standard Wagner Attachments Will Fit: Crane, Plows, Fork Lift, Coal Bucket, Snow Bucket, Backfill Blades, and more to come!

Quality Products for More than 100 Years!

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WAGNER IRON WORKS, Dept. RS 1153
1905 S. 1st Street • Milwaukee 1, Wisconsin

Please send me more information on the Wagner WSL Swing Loader to fit a ..... model ..... tractor.

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ROLLIN' WITH THE PUNCHES

DIAPHRAGM LIFE INCREASED

10 TIMES

Under terrific punishment it stays in the fight . . .

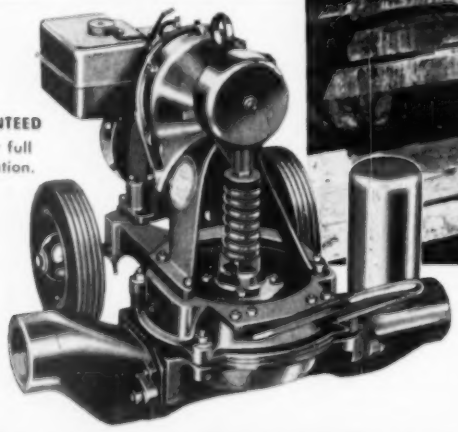
REFUSES TO QUIT

GORMAN-RUPP *firsts!*

- Diaphragm drive rod spring-cushioned on down stroke. Runs smoothly.
- MORE PUMPING — by as much as 400% at 25 feet static lift.
- Suction Accumulator provides continuous smooth flow of water.
- One Man Handling — only 128 pounds — Job-to-Job.
- Easy hook-and-tighten with hose connected.

FIRST REAL IMPROVEMENT EVER IN DIAPHRAGM PUMPS

GUARANTEED
Ask for full information.



Exclusive features entirely new in diaphragm pumps — under patent applications.

GORMAN-RUPP

DIAPHRAGM PUMPS

THE GORMAN-RUPP COMPANY
MANSFIELD, OHIO

assigned to secondary or ward routes and are then under direction of the Ward Foremen.

All municipal equipment in Milwaukee is operated and serviced by the Bureau of Municipal Equipment which rents its equipment to other bureaus. When this bureau receives the snow plowing alert, its employees immediately start mounting plows on its trucks. The Bureau operates from six garages scattered about the city. Designated ward laborers and Garbage Bureau laborers report to the garages for work as helpers on plows or in the garages. Mounting of plows being finished, the operators report for assignment at 11:00 P.M. Each operator is furnished with a card showing the map of his route and the streets to be plowed. Two pieces of equipment are assigned to each route. The initial assignment of plows is two to each of the forty primary routes and the balance to the 31 districts or secondary routes. There are 220 plows available, including 30 privately owned. As main routes become completed, there is a doubling up of plows on the secondary routes or residential districts.

How Jobs Are Assigned

When a plowing route is completed, the operator reports into the Bureau of Municipal Equipment Dispatcher for further assignment. At the same time the field supervisor is reporting the information to the Snow Office in the City Hall. That office has previously designated where the next plows available are to be assigned. In this way the equipment is assigned to a district immediately. An ordinary storm is plowed in about ten hours.

Inasmuch as nearly all equipment operators are used during the night to plow snow, the day following there is no regular program of ash and rubbish collection. The ward laborers are used to clear snow from catch basins, hydrants, and crosswalks. Much snow is removed from private sidewalks, and the cost assessed on tax bills to the owners. As many as 40 jeeps and sidewalk plows are put in operation for walks. If the quantity of snow warrants, end loaders are used to load snow from important intersections. In the downtown areas this usually takes one day and in the outlying districts the following one or two days are required.

The large scale removal of loading of snow from main arteries and business districts is assigned to the Bureau of Street Construction and Repairs. This is a night operation usually. Operating units are made up consisting of a rotary loader, perhaps a dozen privately owned trucks of large capacity; as the City owns six rotary loaders it is possible to put six such crews to work. The Bureau of Street Construction uses its own field supervisors and repair foremen, but receives most of its man power from the Bureau of Forestry. Both

More footage per day...
More footage per blade...
LOWER COST PER CUT!

Felker DI-MET
MODEL 252
The heavy duty
CONCRETE CUTTER
that pushes itself!

CUTS MORE CONCRETE PER DAY BECAUSE THE MODEL 252 IS SELF-PROPELLED! OVERCOMES OPERATOR FATIGUE, ELIMINATES FREQUENT REST PERIODS, COVERS FAR MORE FOOTAGE IN A DAY!

★ LONGER BLADE LIFE—No sudden bumps and jolts to add unnecessary wear and tear on the diamond. wheel. Smooth, uniform POWER FEED adds longer blade life—CUTS COSTS! Actual field reports have shown blade life as much as doubled.

★ DEEP CUTS—approximately 7" maximum with 18" blade. 13.5 h.p. engine furnishes power to spare.

★ DOUBLE END SPINDLE for right or left hand cutting.

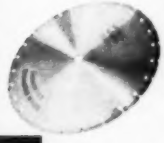
★ HINGED BLADE GUARDS—Front half lifts, exposing blade for close-up work.

POWER — SPEED — MANEUVERABILITY
PLUS LOW COST!

Felker DI-MET Model 135 Here's the concrete cutter for your every-day jobs... trenching, patching, cutting curbs, ramps and dozens of other uses! Light, easily maneuverable with powerful 13.5 h.p. engine. Built for 12" blades but powerful enough for 18" blades (with special guard). 3 wheel design. Other concrete cutters available.
Ask for details!

Use DI-MET Machines and Blades for every concrete cutting requirement!

Here's an unusual application—sawing up and re-locating a concrete wall! Savings: $241.00 on a $991.00 job!



Felker DI-MET the SEGMENTED type diamond blade with peak performance! Built by the only manufacturer making both concrete cutters and diamond wheels. Bond variations for every cutting requirement insure more footage—lower cost per cut!

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TORRANCE • CALIFORNIA

Ask your Felker DI-MET Representative for recommendations.

World's Largest Manufacturer of Diamond Abrasive Cut-off Wheels and Equipment

these Bureaus are on minimum work programs at this time of the year, whereas, the Bureau of Street Sanitation must return to rubbish collection as soon as possible after a plowing.

A City ordinance empowers the Mayor to declare an emergency and order all trucks and automobiles off the streets. This authority has helped speed up the clearing of the streets and permits the plows to do a cleaner job. We are enclosing one of our posters concerning the parking ordinance.

During 1952 we had six snow storms requiring a major effort in plowing the streets. Upwards of 190 motorized plows worked 15,840 hours. The total snow fall for the year was 54.0 inches. Cost operations were as follows:

Motor plowing of streets	$151,583.86
Hauling of snow by ward crews	23,478.15
Opening of cross walks and catch basins	111,030.83
Maintenance of sand boxes, 916 locations	42,705.56
Emergency sanding of streets	177,264.63
Snow fences, snow dumps, city property	11,753.71
Snow clearance by the Bureau of Street Construction (rotary plow crews)	31,433.90
	$549,250.64

Equipment bought in 1953 which can be used in snow removal has included.

12 Compression Packers (plows can be attached)
13 Salt Spreaders
6 Sand Spreaders
8 16,000 lb. Trucks, snow plow equipped
5 24,000 lb. Trucks, snow plowed equipped
1 38,000 lb. Truck G.V.M.
12 24,000 lb. Trucks G.V.M. equipped with rubbish boxes

The City of Milwaukee has had quite satisfactory experience in the use of salt spreaders for removal of light snows and as a substitute for sanding slippery intersections.

WARNING!

CITY OF MILWAUKEE NIGHT PARKING ORDINANCE

SUMMER REGULATIONS

BETWEEN APRIL 16th and NOVEMBER 15th (incl.)

On all streets you *ARE* allowed to park for *NOT MORE THAN 2 HOURS* between 2:00 A.M. and 6:00 A.M. If you have an all night parking permit issued by the Police Department, you may park all night as provided by the permit.

However, between 2:00 and 6:00 A.M. you are allowed to park only:

1. On ODD dates of the month, on the side of street having ODD house numbers.
2. On *EVEN* dates of the month, on the side of street having *EVEN* house numbers.

EVEN and ODD dates are figured *BEFORE MIDNIGHT* each night.

WINTER REGULATIONS

BETWEEN NOVEMBER 16th and APRIL 15th. (incl.)

AT NO TIME are you allowed to park on arterial highways, bus lines or street car lines between 3:00 A.M. and 6:00 A.M.

You are *NOT* allowed to park on arterial highways, bus lines or street car lines between the hours of 11:00 P.M. and 6:00 A.M. for the period of 48 hours from the time designated by the Commissioner of Public Works in an announcement on local radio stations that a snow emergency exists. *(A snow emergency is defined by the ordinance as existing when three or more inches of snow falls in 24 hours.)* If snow plowing work following the announcement of such emergency has been completed in less than the 48 hour period, the Commissioner of Public Works will announce that the emergency is over and that these parking restrictions are withdrawn.

On all streets other than arterial highways, bus lines, or street car lines, you *ARE* allowed to park for not more than 2 hours between 2:00 A.M. and 6:00 A.M. unless you have an all night parking permit issued by the Police Department.

If you have a permit you are allowed to park only:

1. On ODD dates of the month on the side of street having ODD house numbers.
2. On *EVEN* dates of the month on the side of street having *EVEN* house numbers.

EVEN and ODD dates are figured *BEFORE MIDNIGHT* each night.

Cars parked in any violation of above, may be hauled away at owners expense.

CITY OF MILWAUKEE
Common Council Ordinance
No. 525-47-2291—Sec. 101.93 101.90.5

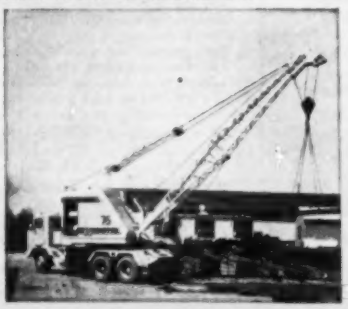
GarWood 75

New Cranes Designed for More "On the Job" Time!

Handle all types of precision steel erecting, concrete work and any crane, clam, magnet or dragline job with the new standard-duty 75A or heavy-duty 75B Gar Wood cranes! . . . Collapsible high gantry simplifies raising of longest booms . . . Pendant cables speed changing of boom lengths . . . Optional *power load lowering* and *fluid coupling* give smoothest possible crane operation . . . Hammer head boom point keeps cable away from boom — gives added boom strength — keeps cable costs low . . . Crane sections pin and bolt connected for rigidity and strength . . . Right angle drive, power actuated hoist clutches and conical hook rollers . . . Easily converted to all attachments including the new, exclusive Gar Wood Foundation Borer!

FOR LIFTING POWER with MOBILITY

A Gar Wood 75BT truck crane will do the job. Lifts up to 40,000 lbs. Has all the heavy-duty features yet gets around fast. Ideal for long boom and steel erection work.



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F-532

GAR WOOD INDUSTRIES, INC.

Findlay Division • Executive Offices • Wayne, Michigan

Notes on Pittsburgh's Snow Plowing and Sanding Methods

By Jas. S. Devlin

Director of Public Works
City of Pittsburgh, Penn.

When snow reaches a depth of about 3 inches in Pittsburgh, parking is strictly prohibited on all primary streets and certain secondary streets. Snow is then plowed to the curb and loaded by Barber-Greene loaders and hi-lifts. It is then disposed of in either the Monongahela or Allegheny Rivers.

Snow is removed first from 12 miles of streets and ways in the downtown, or Golden Triangle area. However, approximately 250 miles of streets are plowed open, and snow is removed from about 75 miles.

The following equipment, which is city-owned, can be used in the removal of snow:

167 Trucks
4 Bulldozers
4 Snow loaders
11 Graders
5 Hi-lifts
50 Truck-attached snow plows

Pittsburgh snowfall for the 1951-1952 winter amounted to 27.5 in.; during the 1952-1953 winter, 23.9 in.; average over a 68-year period, 34.7 in.

Labor costs for snow and ice removal from October 1, 1951, to March 31, 1952, amounted to $35,384.48, while cindering and salting for the same period cost $83,034.39. Comparable figures for the 1952-1953 winter were $11,462.78 and $86,102.54.

During the winter of 1951-1952, 1467 tons of salt costing $28,899 were used, while during the winter of 1952-1953, 1870 tons were used, at $36,839.

The snowfall for the two winter seasons mentioned above was considerably below the average. During the exceptional winter of 1950-1951, 82 in. of snow fell, necessitating hired equipment in addition to our own at an additional cost of approximately $600,000, the units included: 366 trucks, 42 bulldozers, 7 snow loaders, 22 graders, and 64 hi-lifts.

Special fog belt markers planned for N. J. Turnpike

As an answer to the serious traffic tie-ups caused by Autumn fog in the New York metropolitan and surrounding region, the New Jersey Turnpike Authority is installing fifteen special neon lighted signs. These are designed to warn motorists of approaching traffic hazards.

The signs which have interchangeable legends are placed on the Turnpike's 31-mile northern belt most affected by fog, north of the Raritan river to the northern end. The signs

are 12 ft. wide and are mounted on steel supports on the road shoulder.

After determining that recent experimental signs with extra large letters were inadequate, the Turnpike engineers decided on 30-inch-high lettering in red, directing motorists to slow down. Below, in 20-in. lettering, a supplementary message will tell of the specific condition such as fog, rain, snow, ice, accident, or construction ahead.

In addition, turnpike police will install flares in extreme weather conditions to mark boundaries of dangerous areas. Toll booth employes also will issue warnings. And in thick fog areas the turnpike will have stand-by wreckers to convoy moter vehicles through when necessary.

Conditions on the southern 87 miles of the turnpike are being studied to determine the necessity of similar special weather safety measures.

Engineers study faster map production methods

Negatives are out of style at the Army's Engineer Research and Development Laboratories, Fort Belvoir, Virginia, where topographic engineers are taking a "positive" approach in the field of map reproduction.

Since World War II brought maps down to the common soldier, methods to produce them in great quantities are urgently needed. In an effort to develop a method which will provide photomaps in great numbers for quick delivery to troops in the field, ERDL is investigating the ammonia process for prints from positive film.

The ammonia process, often referred to as the diazotype method, utilizes a paper coated with a light-sensitive dye intermediate which can be selectively decomposed or bleached by light. When this paper is exposed to light in contact with a transparent positive original, and then subjected to ammonia fumes, a direct positive of the original is produced.

Present methods of ammonia process print production from aerial negatives require that a conventional silver halide film positive be made from the negative. The positive is produced by contact or projection printing using conventional photographic materials, methods and processing. However, the procedure is exacting in that the film positive must be of a specified contrast and density in order to produce satisfactory prints.

Once a film positive is available, ammonia process prints are easy to make in a specially designed machine. Only two direct steps, printing and dry development, are necessary. Production of these prints is simple when compared with the making of photographic prints. Five steps (darkroom, developing, fixing, washing and drying) are eliminated in the production of large quantities, resulting in great savings in both time and labor.

WHEN YOU'VE GOT A MIX on the road, it's not easy to change delivery instructions... *unless* you're equipped to talk to your driver on 2-way radio.

With RCA 2-Way Radio you turn today's headaches into worthwhile profits . . . by maintaining constant contact with all your trucks. To reroute a load fast, you call the driver and give him new instructions. To make use of an undelivered load, your driver calls you for instructions. No wasted mileage, no lost time.

Here is your best bet for more income per truck, more deliveries per hour. It will pay you to look into RCA 2-Way Radio for complete control of deliveries from your office, your car, or your home.

Do it BEST with RCA 2-Way Radio

EASY TO USE as your telephone • **COMPACT**—takes less vehicle space than a spare tire • **TOUGH**—built to take the roughest field conditions • **RELIABLE**—engineered by the leaders in electronics • **PRACTICAL**—local service available from RCA Service Company.

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Radio Corporation of America, Communications Equipment
Dept. 202W, Building 15-1
Camden, N. J.

☐ Please send me information on RCA 2-Way Radio
☐ Have an RCA Representative get in touch with me

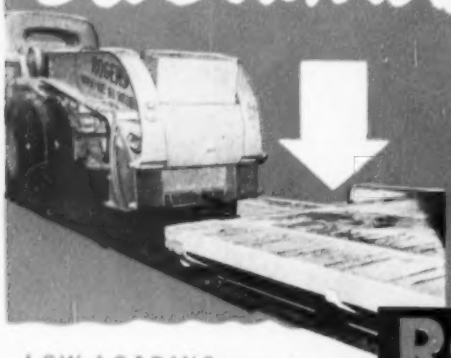
Name_____ Title_____

Company_____ Address_____

City_____ Zone_____ State_____

RCA® **RADIO CORPORATION of AMERICA**
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

"Get Down to Business"



TO A LOW LOADING DECK HEIGHT OF ONLY 16" WITH THE VERSATILE TYPE "TPG"...

ROGERS POWER LIFT DETACHABLE GOOSENECK TRAILER

PATENTS PENDING

LOW LOADING permits an easier, faster, more profitable operation in hauling equipment to and from the job.

Shovel "walks" up low deck over a minimum of blocking and rampage. *There is no stress or strain applied to the frame or gooseneck.* No blocking required under frame.

For your best buy in a multi-purpose, heavy duty trailer, investigate this versatile unit. It incorporates every desirable "job-proved" feature originated by Rogers.

CAPACITIES: 15, 20, 25, 30, 35, 40, 50, 60 & 75 TONS

DETACHES, LOADS AND ATTACHES IN 5 MINUTES — LOADS EASILY OVER LOW FRONT OF DECK — RAISES ITS DECK TO CLEAR HIGH BANKED CROSSINGS — STOOPS TO CLEAR LOW OVERHEAD OBSTRUCTIONS — 20" & 24" TIRES INSURE GREATER TIRE LIFE, LARGER AND MORE EFFECTIVE BRAKES: AND OFTEN PERMIT INTERCHANGEABILITY WITH TRACTOR TIRES.

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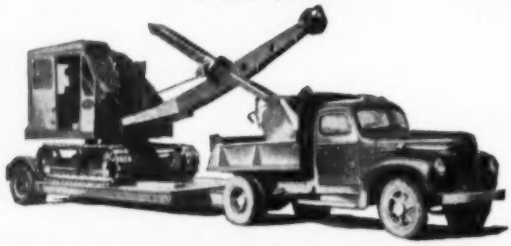

Also of timely interest in this ROGERS Tag-A-Long trailer which makes a dump truck serve as a tractor and effects sizeable savings for contractors.

Electronic Toll Collection Planned for Thruway

A COMPLEX, "foolproof" toll-collecting system has been developed for the New York State Thruway. Described as "a model for all future projects of a similar nature," its importance is explained by Holden A. Evans, Jr., Executive Assistant to Authority Chairman B. D. Tallamy.

The importance can hardly be overestimated, said Mr. Evans, since inadequate control could lead to loss of revenue on a fantastic scale. The toll collection equipment is now being manufactured by the Brooklyn firm of Taller and Cooper, Inc., under a $2,447,000 contract. A contract for the office tabulating equipment is to be awarded to Remington Rand, Inc. The system is expected to get a "dry run" early next year when the Authority plans to inaugurate toll collections on a 150-mile section of the superhighway between Utica and Batavia.

Meantime, certain refinements probably will be necessary before the new toll system is put into operation on 37 "trumpet" type toll interchanges on the main Thruway section. The entire 427-mile New York-to-Buffalo section is scheduled to open late in 1954.

Three Toll Methods

The Thruway's toll-collecting system was developed after intensive study of the facilities used on the Pennsylvania and New Jersey turnpikes as well as on other self-supporting projects. The design of the New York system was complicated by the fact that there will be three methods by which the motoring public will pay its way.

Motorists with automobiles registered in New York State will be permitted to purchase annual Thruway permits, which will entitle them to unlimited use of the roadway. Trucks, commercial vehicles, out-of-state motorists, or those without the special Thruway permits will pay tolls based on a schedule computed on a per-mile-traveled basis. In addition, charge accounts will be available for commercial vehicles.

On the surface, the Thruway toll collection system does not differ substantially from those in use on existing turnpikes. This involves the use of a tabulating card, which will be issued to each motorist as he enters a "controlled" section of the highway. Each card will show the type of vehicle, and where and at what time it entered the Thruway.

When the vehicle leaves the Thruway, the card will be presented to a collector, who will use a machine to determine the correct toll. Holders of annual Thruway permits will surrender their cards without paying any trip fee. For those trucks holding credit cards, the toll will be tabulated and recorded by machine for

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future collection from the credit customer.

Among the features incorporated into the Thruway toll-collecting system, to guard against possible fraud, is the use of a treadle, placed in the pavement at each entrance and exit lane of a toll station. The device will record the number of axles on each vehicle.

Photo Method

As the front axle passes over the treadle, a camera will snap a picture of the lower portion of each vehicle to show the presence of a permit insigne or a charge-account identification, Mr. Evans explained. Also included in the photograph will be enough of the vehicle so that its proper classification can be determined. The records of the treadle and the camera will be checked to verify the vehicle classification made by toll-station personnel.

The charge-account method of paying tolls, the Thruway official predicted, would be used widely because of its convenience to trucking organizations. For this system, the Thruway and its consultants are studying a principle employed for many years by department stores. Each commercial vehicle traveling on a charge account would carry a "charge plate" similar to those used by some department stores. These vehicles also would display a charge-account identification insigne, probably on their front bumper or radiator.

Chicago-Miami toll road pushed by six states

The idea of an expressway from Chicago to Miami was advanced a step further recently, when representatives of six states met in Kentucky at the request of Governor Weatherby. One proposal discussed was an offer to build a toll road with private capital at an estimated $1½ billion cost, on a revenue bond basis. A penny a mile toll was envisioned, equivalent to about $14 per motorist for the full trip.

The proposal, which would cut a full day off the present 1500 to 1600 mile trip, was weighed by delegates consisting of Governor George N. Craig, Indiana; Governor Frank Clement, Tennessee; Herman E. Talmadge, Georgia; Earl P. Power, chairman of the Florida toll road authority; and James Adams of the Alabama governor's office.

A possibility seen was the ultimate construction of toll roads in some of the states, tying together on an agreed route, with other states developing a higher type of freeway construction on their segments.

Wegner Promoted by Cleaver-Brooks. Elmer H. Wegner, formerly acting works manager, has been appointed general manager of manufacturing for Cleaver-Brooks Co., Milwaukee, Wis. Glenn W. Leupold has been appointed works manager.

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Wanted: civil engineers

(Continued from page 97)

signed to stimulate interest among graduating high school youth. In essence, the program provided for recruiting with the help of the University's summer school facilities at Camp Davis, a 120-acre plot surrounded by mountains, located about 14 miles from Jackson, Wyoming.

Three tough questions arose: What kind of a course could be offered? On what basis should students be selected? And how could the program be financed?

The later question was answered with the writer's help. Michigan's road builders have long been keenly aware of the shortage of civil engineers and trained labor. Thus, when the idea was presented, the Michigan Road Builder's Association agreed to under-write approximately 50 per cent of the cost of the program. Tuition fees, board and other expenses incurred in attending the camp totaled $220 per student, and the Association appropriated $100 per student in the form of student aid.

In February, Boyce appointed Professor Donald Cortright of the University's Civil Engineering Department to serve as coordinator to work with Foster and the writer in setting up a worthwhile program. The University's regular Camp Davis summer course consisted of two separate four-week courses. However, it was felt that more could be accomplished if the course for high school graduates was planned for one closely knit eight-week period. In essence, it was a "well rounded" program of work and recreation.

To qualify for the course, it was necessary for high school graduates to have completed a high school course in trigonometry; satisfactorily met entrance requirements of the University of Michigan's Department of Civil Engineering; and successfully passed the Michigan Civil Service examination for Engineering Aide B.

Attractive to H. S. Boys

The program was made particularly attractive to graduating high school youth through a special arrangement with the Civil Service Department. Students who completed the course were offered jobs as Engineering Aides B with the State Highway Department at a starting salary of $253 per month, plus per diem expenses while in the field, rather than the normal initial salary of $231. Top pay for Engineering Aides B is $3,296 annually, and is attained in six step raises. Thus, students completing the course were permitted to start at the second step and, with satisfactory work, advance to top pay within three years.

The University provided additional incentive by agreeing to give credit for work successfully completed at the camp to those students who preferred to continue the study of civil engineering at the University, rather than go to work.

Through the cooperation of the Michigan school system, circulars and pamphlets were circulated through all high schools in the state to stimulate interest.

Year's Program Succeeds

The success of the Michigan program is evidenced in the fact that out of the group of thirty, only one decided that engineering was not his field, and dropped out. Of the balance, 16 went to work for the highway department upon completion; seven of them on a temporary basis with the hopes of attending college soon to study civil engineering. One has already tendered his resignation and will attend the University of Michigan this fall. The remaining 13 are entering various Michigan colleges this fall to continue their engineering studies.

Because of the success of this year's program, the University of Michigan has expressed its willingness to continue the course next summer, and the possibility of providing additional facilities is being considered by Michigan State College. The Michigan Plan is also being studied by other states suffering man-power shortages in civil engineers.

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SOIL-CEMENT
Justification for its use

By I. E. Russell
Chief Materials Engineer
Wyoming State Highway Department

A paper presented at the annual meeting of Western Highway Officials, October 7-9, Santa Fe, New Mexico.

THE topic "Soil-Cement—Justification for its Use" has been assigned for this panel discussion. The very wording of this topic would seem to imply there are doubts, perhaps even grave doubts as to the merits of cement bound bases. Were this a new and untried type of construction there might be reason for such doubts but the widespread and constantly increasing use of this type backed by factual information showing excellent service records for a number of years should surely dispel such doubts.

Quite naturally the decision as to the type of base construction to use must be resolved on the basis of initial cost, maintenance costs, road life and performance under the conditions to which it will be exposed. In the case of soil-cement the first cost is dependent mainly upon two items (1) the amount of cement required and its cost and (2) the soil to be used—that is, whether it is the in-place material, roadside borrow or borrow that must be hauled some distance. Quite frequently, when in-place or nearby soils can be utilized for making the soil-cement base, this type will have a first-cost advantage—particularly where materials considered suitable for a good granular soil-bound type of base construction are not readily available or are unduely expensive.

1952 Project Described

A project recently constructed in our State provides an excellent example.* On this project, a 65-mile rail haul would have been involved in providing satisfactory material for a normal soil bound-gravel base course. By utilizing a nearby waste pile of scoria fines and constructing a hardened scoria-cement base an estimated saving of approximately twelve thousand dollars per mile was made on a seventeen-mile section of highway.

*"Cement Stabilization turns Scoria into Asset in Wyoming"; Roads and Streets, September, 1952.

Consideration must also be given to the relative cost of one type of base as compared to another type designed to provide equal quality and service. In this respect, the cement-bound base gains another advantage as regards first cost since a lesser thickness will be required to provide such quality and service. On the above mentioned project, information there available was to the effect that six-inch thickness of soil-cement was equivalent in supporting value to eight inches of granular base and the project was constructed accordingly. As of this date, we have no reason to indicate our decision was unsound.

While cement-base construction can often be justified on the basis of first cost alone, there are, of course, many instances where this is not the case. Even in these cases it is quite possible to justify its use on the basis of better performance and lowered maintenance costs. A condition survey of soil-cement roads made in 1947 by the Highway Research Board, which, no doubt, many of you have read, shows remarkable performance on many miles of this type. A very considerable mileage, percentagewise, shows no failure on such roads ranging in age from two to ten years and carrying total daily traffic up to 2250 cars.

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This deep beam type rail mounts directly on the post and provides mounting holes every 7½ inches to facilitate post positioning. "Adjacent to post" splices are easily made. No special mounts, or end anchoring required.

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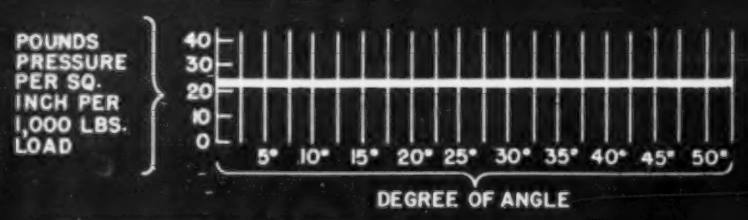
ISO-DRAULIC ROLL-A-LIFT

OIL PRESSURE DEMAND FOR THIS INSTALLATION IS 21.7 LBS. PER SQ. INCH FOR EACH 1,000 LBS. OF LOAD, IE: Payload plus weight of specified body. This pressure demand remains constant from 0° to 50° dumping angle.



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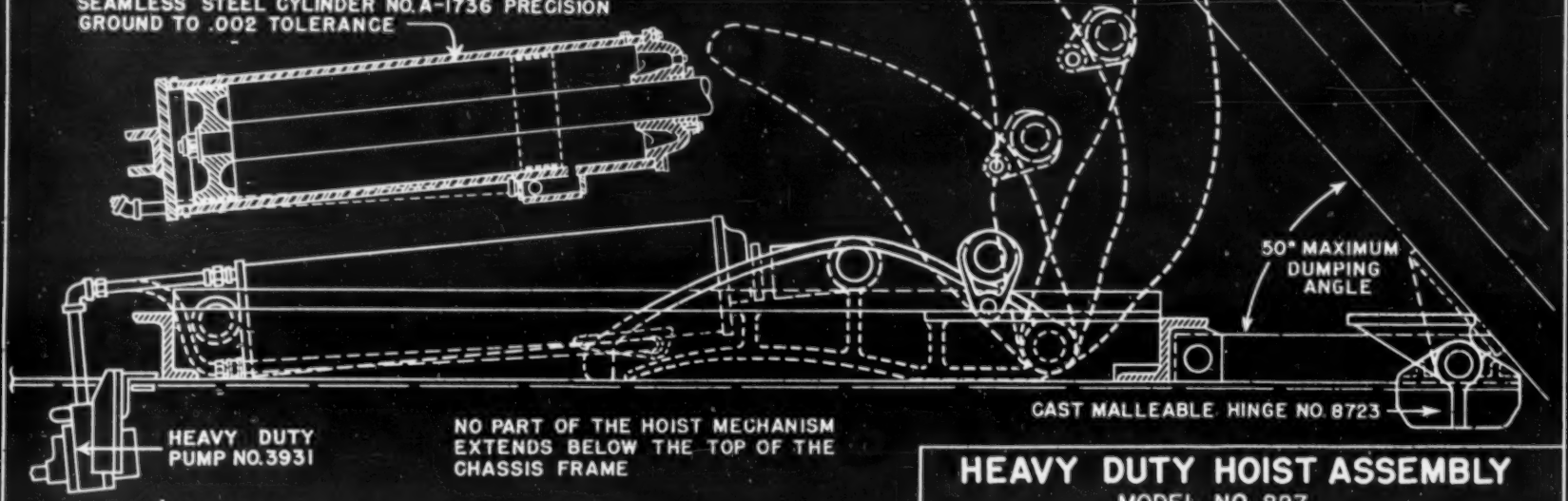
SEAMLESS STEEL CYLINDER NO. A-1736 PRECISION GROUND TO .002 TOLERANCE



NO PART OF THE HOIST MECHANISM EXTENDS BELOW THE TOP OF THE CHASSIS FRAME

HEAVY DUTY HOIST ASSEMBLY

MODEL NO. 827

DATE 4-446	SCALE 1"=1'-0"	DR'N W.A.Wagner	A-144A

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THIS BLUE PRINT
taken from the files of The Perfection Steel Body Company tells an important story.
The goal of all hydraulic engineering is even pressure throughout working cycles. This goal is achieved in Perfection's line of ISO (even pressure)— DRAULIC Roll-A-Lift heavy duty hoists for dump bodies from 9 ft. to 18 ft. in length.
The pressure chart indicates a practically flat curve throughout the dumping cycle. This means the system exerts the least possible effort while lifting and, therefore, maintains greater loads. No severe shocks are transferred to the hoist or truck frame, giving longer trouble free service. If you would like to know what this engineering achievement means to you as a truck operator, please write us for information.
THE PERFECTION STEEL BODY COMPANY
DEPT. NO. R-113
Galion, Ohio

with truck traffic as high as 265. While this is a remarkable record, it must be remembered that many of these projects were built some years ago and better equipment and construction methods are in use today.

Why Soil-Cement Performs

There are a number of reasons why soil-cement bases perform so well. For the same thickness it is stronger than the normal dense graded granular bases and is therefor capable of carrying considerable traffic with a minimum of failure. Tests show that it continues to gain strength with the years. Its strength and rigidity is sufficient to prevent edge failures and to carry normal load over local areas of weak subgrade. Soil-cement bases are not softened and therefor do not lose bearing capacity in the presence of moisture as often ocurrs in granular bases particularly if any plastic fines are present.

These are some of the reasons, and doubtless there are others, why soil-cement has provided such an excellent record of performance. The many years that some of these bases have been in service is indicative likewise of an excellent road life.

Old Granular Bases Saved

The use of cement in the salvaging of old granular bases that are no longer adequate for the increasingly heavy traffic is coming into more and more use. This is possible even tho the old base is covered with bituminous surface. The bituminous mat is broken up, mixed with the granular base, cement and water are added, and the base reconstructed in the usual manner as a cement bound base.

A problem confronting many departments today is that of finding sufficient quantities of suitable granular materials for base construction. It is evident that many sources containing, so-called, border line or inferior materials will have to be used. Plastic fines in base course gravels are unquestionably the cause of many failures. Such materials can be greatly improved and fairly high plasticity indices reduced to zero by the use of cement in quantities as low as one to two per cent. In this manner, the supply of materials for use as base course can be greatly increased.

On one project which we constructed last year, the only pit available within reasonable haul distance was borderline in respect to plasticity index and dust ratio. In spite of careful control, materials could not be produced from the pit that would comply with specification requirements. Cement, in the amount of two per cent was added to the material on the road and processed with the result that both the plasticity and dust ratio were brought well within the specifications.

Summarizing, then, it would seem that soil-cement can frequently be justified on first cost alone. When this is not the case, it may still be justified by virtue of better performance, lower maintenance costs and long life. Certainly there is now sufficient factual information on soil-cement as well as other types of base construction to serve as an excellent guide in making the deicsion as to the type of base most suited for the conditions involved.

Large slag tonnage used in highway work

Slag processed in 1952 totaled 26,899,000 tons valued at $33,874,000 according to figures compiled by the National Slag Association and issued by the U. S. Bureau of Mines. Forty-two companies operated 67 plants for processing air-cooled slag and 18 plants made expanded slag. Fourteen firms produced granulated slag.

The major product, screened air-cooled slag, was used largely for railroad ballast, as aggregates for portland cement and bituminous concrete work, and for miscellaneous highway purposes.

Unscreened air-cooled slag production went 39 per cent for highway and airport aggregate, 17 per cent railroad ballast, the remainder miscellaneous.

Granulated slag totaling 2,507,000 tons was used 48 per cent for road fill, 43 per cent as raw material for hydraulic cement making; the rest for cement block making, agricultural slag and liming, and miscellaneous.

Expanded slag production totaling 1,970,000 tons was used principally in the manufacture of light-weight cement blocks.

The industry tonnage was off about 9 per cent over 1951 due principally to strikes.

Average value per short ton of iron blast-furnace slag sold or used by processors in the United States in 1952, by uses (National Slag Association)

Use	Air-cooled Screened	Air-cooled Unscreened	Granulated	Expanded
Aggregate in:				
Portland-cement concrete construction	$1.36	.....	.....	*$2.62
Bituminous construction (all types)	1.42	.....	.....	.....
Highway and airport construction†	1.37	$0.64	.....	.....
Manufacture of concrete block	1.33	.....	$1.55	2.32
Railroad ballast	.98	.35	.....	.....
Mineral Wool	1.34	.....	.....	.....
Roofing (cover material and granules)	1.97	.....	.....	.....
Sewage trickling filter medium	1.69	.....	.....	.....
Agricultural slag, liming	1.46	.....	1.34	.....
Road fill, etc.	.....	.....	.64	.....
Other uses	1.20	.54	.58	1.85

* Lightweight concrete.
† Other than in portland-cement concrete and bituminous construction.

$133 million contracts awarded for Ohio Turnpike

Ohio Turnpike Project No. 1 was 62.1% under contract as of October 13, when construction contracts covering 25.3 miles of Turnpike roadway were awarded by the Ohio Turnpike Commission. The awards totaled $19,827,741.49.

A total of 149.9 miles in 40 construction sections, including the four largest bridges were under contract, as of that date. The entire Turnpike is 241.4 miles long and is divided into 62 construction sections, all of which are scheduled to be under contract by the end of 1953.

Roadway and structural steel contracts let to date amount to $133,830,708.70, which is 63.2% of the total estimate of $211,875,568.00 in the report of August 15, 1951.

JOB and EQUIPMENT IDEAS

Mixer water supply tank mounted on crawlers

Sometimes the water supply for the paver has to be secured by traversing soft or rough ground. In this case there is a real traction problem, if the supply or booster tank is of any size.

Here is how James Capes & Sons Co., of Racine, Wisconsin, rigged up a tank for feeding the paver on U. S. 41 reconstruction a couple of summers ago. The crawlers are from an Athey wagon. This outfit could negotiate plowed ground or "what have you."

Drilling concrete holes on the slant

Drilling twenty 2½-in. holes at a 45 degree angle through 18 inches of concrete reinforced with imbedded steel rods was the problem faced recently by the Dawson and Evans Construction Co., Cincinnati, Ohio. The job was done using a concrete core drill, mounted on a 450 wooden carriage, as pictured.

The drill employed was a Tilden unit with one-horsepower motors, using water to flush cuttings from the holes, and a coolant. The drill had eight tungsten carbide cutters and a patented core slot in the side of the drill body for easy removal of the core.

★ Solid concrete core (Above) as removed from Tilden drill. (Below) Sintered carbide cutters have cut through several steel reinforcing rods.

★ Rotary concrete drill and one-horsepower drill motor shown supported on special 45-degree carriage for cutting through reinforced concrete

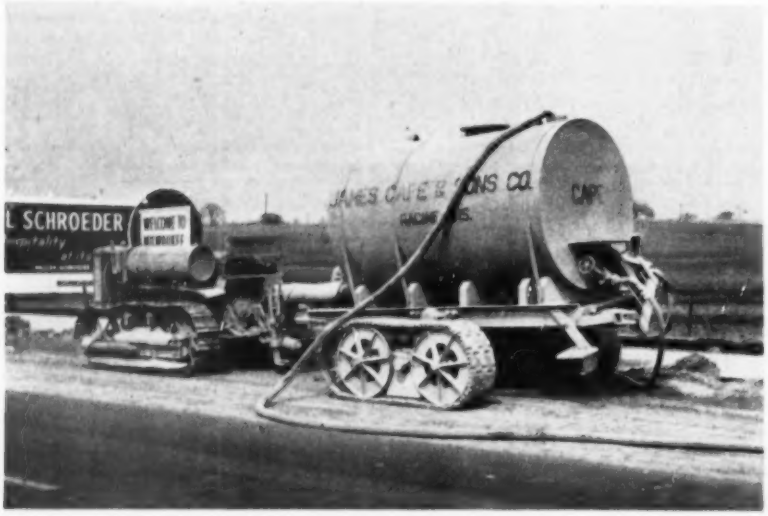
Self-locking clamp aids steel riggers

As described in the Navy BuDock's "Technical Digest" No. 32, the self-locking clamp pictured here was developed for use with attached hook and pulley in placing and removing purlins on Butler buildings. It may also suggest other uses or adaptions to Roads and Streets readers. Dewey Fipps and Foy Yost, riggers at the Navy Civil Engineering Research and Evaluation Laboratory, at Port Hueneme, Calif., devised the clamp.

The clamp is placed on the bent on which the purlin is to be set. A pulley is attached to the clamp and the hook is inserted into the bolt hole of the purlin for hoisting. The weight of the purlin on the pulley causes the safety catch of the clamp to bite into the lip of the I-beam, preventing slippage.

The old method of putting on purlins involved the use of two hooks, one attached to the bolt hole of the I-beam and the other to the purlin. This arrangement made it necessary for the rigger to lean over and lift the purlin a foot or more by hand. He then had to hold it while the hook was removed from the bolt hole and the securing bolt inserted.

By use of the self-locking clamp the line may be left on the purlin until it is secured in place, thus reducing



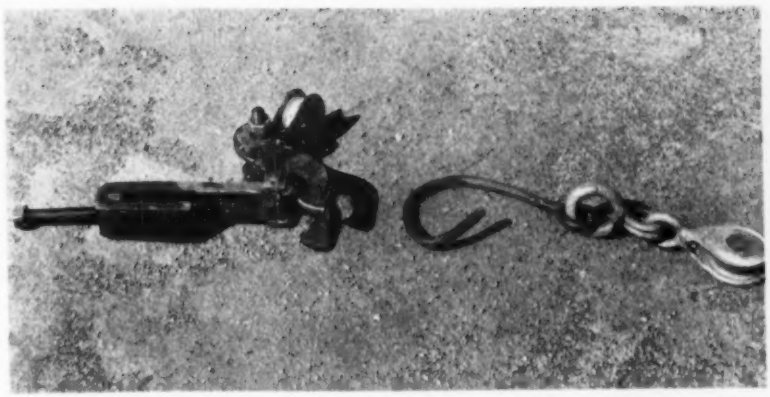
★ How one contractor mounted a water tanker for crossing soft ground

the danger of riggers falling and eliminating the danger of dropping the purlin. The clamp with its attached hook and pulley can be used to hoist other material as well. Also, the clamp unit may be moved along the I-beam to the next position without removing or adjusting it.

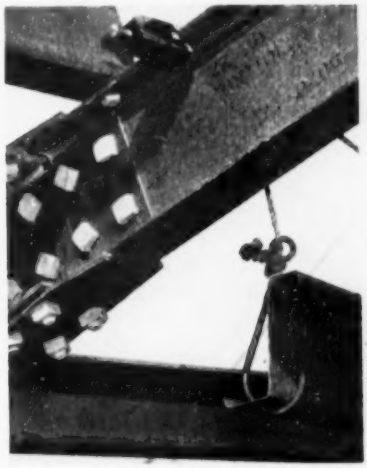
The self-locking clamp method has been put to use during erection time studies on a standard rigid frame 40 x 100 ft. utility building and has proved efficient and satisfactory.

Truck ramp for delivery into ready-mix batcher

You don't always have to have a high hillside to take advantage of gravity material to your batch plant. A small rise of ground can be built up by a dozer operator, as he is pictured in the accompanying scene. This plant is one set up by Holloway & Sons, excavating and grading contractors, of Middetown, Kentucky, for transit mix operation. An International TD-14A tractor with bulldozer built a ramp 35 ft. high by 100 ft. long, so designed that trucks could go up, turn and back to the dump with ease and safety.



★ Self-locking clamp outfit. Below it is pictured clamped to the top flange of an I-beam and hoisting a purlin



★ Building a 35-ft.-high earth ramp for gravity truck feed into a transit-mix batch plant

Safety Rules for Handling Explosives

- Do not operate radio within 100 ft. of dynamite area.
- Do not carry caps and dynamite in same car.
- Do not carry explosives in any radio car.
- At any sign of an electrical storm approaching, all loading and other work in loaded area must cease.
- Holes loaded with electrical blasting caps must be fired day of loading.
- Cars and trucks carrying dynamite must have four signs "EXPLOSIVES," front, back and both sides.
- Dynamite and caps left at night must be returned to magazines. No hiding of dynamite in woods tolerated.
- Extreme care of dynamite caps, tamping, testing and shooting may save an accident.
- Disregard of these rules or carelessness may be regarded as a basis for immediate discharge by this company.

Seen on field office wall, New York Thruway project of Savin Construction Corporation, of East Hartford, Connecticut.

• Highest recorded snowfall for a short-duration period in the United States is the 95 inches that fell at Silver Lake, Colorado, in 48 hours in April, 1921. This town also holds the 24 hour record—76 in. in April 1952.

LEADING CONTRACTORS USE McCarthy Drills

PUBLIC UTILITY AUGER DRILL

Bores holes from 4½" to 24" in diameter under sidewalks, roads, building foundations, railroad tracks, landscaped grounds, etc. Fithian Contracting Co., Youngstown, O., using McCarthy Public Utility Auger Drills, completes pipe line jobs, formerly taking weeks, in a few days.

SELF-PROPELLED HORIZONTAL AUGER DRILL

Will bore 6" and 8" diameter holes 120 feet horizontally at rate of six feet per minute maximum. Four individual, self-locking jacks maintain correct drilling level. In one day a New Castle, Pa., operator bored holes of various depths totaling 840 ft. through shale and sandstone, using this McCarthy Auger Drill.

Heavy-Rugged Powerful

VERTICAL AUGER DRILL

Operating men who have made actual on-the-job tests find the McCarthy Vertical Auger Drill a standout for mobility, stamina, ruggedness and versatility. On a 2-million dollar, 5-mile stretch of superhighway between Hubbard, Ohio, and Sharon, Pa., The Apex Powder Co., Canton, Ohio, cut blasting costs approximately 20% as compared to air, well or churn drilling. Cutting through two large areas of concentrated rock, 150 holes 15 feet deep were bored for each blasting pattern. 3,000 cubic yards of sand rock were moved at each blast. Due to the ruggedness and mobility of McCarthy Drills, there was no time lost. For further information, write Salem Tool Co. and our distributor will contact you.

SALEM

DRILLING EQUIPMENT SINCE 1901

THE SALEM TOOL CO.

808 SOUTH ELLSWORTH AVE.

SALEM, OHIO · U.S.A.

Recent Legal Decisions

By Albert Woodruff Gray

Road Contractor Bound by Specifications

A road construction company in South Dakota agreed to furnish labor and material for the base and bituminous surfacing of 17.44 miles of highway in that state.

Specifications required a bituminous mat of a fixed width, "2+" inches in thickness. Upon completion of the work it was apparent that the quantity of bitumen and plant mix consumed in this work performed under the supervision of state inspectors, was sufficient for an additional mile of highway.

This contract provided, in part, "The undersigned understands that the quantities mentioned below are subject to increase or decrease and hereby proposes to perform all quantities of work as increased or decreased in accordance with the provisions of the specifications and at the unit price bid."

The stipulation was added, "The said work shall be performed in accordance with the true intent and meaning of the plans and specifications, which plans and specifications are hereby referred to and made an essential part of this contract."

After the final payment had been received the contractor claimed a further $14,953.82 for material and labor expended under the direction of the highway inspectors, over and above that set out in the specifications. The claim was disallowed and the suit brought for a recovery came before the Supreme Court in South Dakota in February, when the recovery was denied.

"If the materials in question were not required in the performance of the contract and outside of its terms, the contractors cannot recover, as materials furnished at the direction of state agents, although they may have been employed to superintend the execution of the contract.

"If the agents of the state make demands not justified by the contract," concluded the court, "the contractors had the right to refuse to comply but the contractors cannot recover if authority was not exercised in accordance with its terms. The authority of the state highway engineer and his subordinates to bind the state must be found in the contract."

Alexander v. State, 57 N.W. 2d 121, South Dakota, February 24, 1953.

When a Road Becomes a Highway

A lawsuit was brought in Indiana for a judgment that a road was a private roadway and to prohibit the removal of barriers and signs designating it to be such private road.

A woven wire fence had been strung across this roadway in 1927 but shortly afterwards was cut and rolled back. In 1942 or 1943 and again in 1949 a chain had been strung across the road but this and similar obstructions had been immediately taken down by any one who wished to use the road, on which truck and automobile traffic during the summer months was heavy.

In its decision of this action the Supreme Court of Indiana said in April of this year, "The general public has traveled the roadway here in question at its pleasure in buggies, wagons, automobiles and trucks, as it desired, without interference for a period of more than twenty years and during that time it has been open to all persons who desired to use it. Since the public continued to use this roadway these acts of obstruction were not effective and such roadway became and is now a highway."

Spindler v. Toomey, 111 N.E. 2d 715, Indiana, April 27, 1953.

Rodgers Elected Vice President. William Rodgers, heretofore general sales manager, has been elected vice president and general sales manager of Blaw-Knox Co., Pittsburgh, Pa.

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Two-Way Radio Proves Invaluable

By J. T. Sharpensteen
County Highway Engineer
Genesee County Road Commission

The full value of two-way radio to a county road commission becomes obvious after a disaster, such as a tornado, has visited a county and put out of service the ordinary means of communication. Such a storm struck Genesee County, Michigan about 8:30 P.M. on June 8. In a few minutes 115 lives were snuffed out, 700 persons injured, 400 homes destroyed, 300 automobiles damaged beyond further use, 2,000 trees along 30 miles of county road blown down, completely blocking highway traffic, 5,000 trees in one county park laid flat, and damage was done to farms, factories and other property running into millions of dollars.

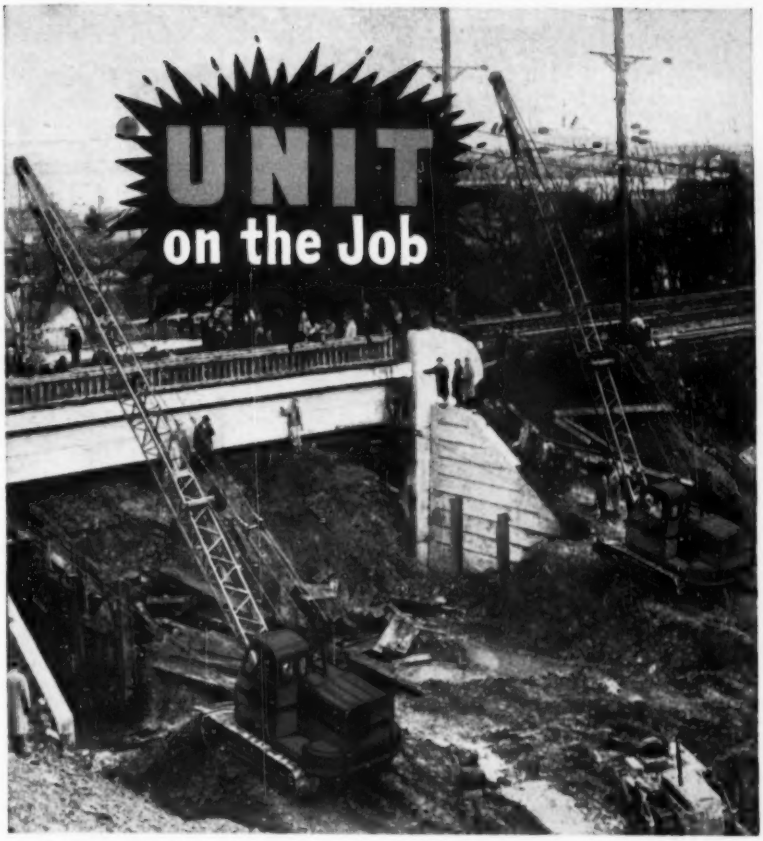
The tornado travelled from west to east along Coldwater Road across the county. This road is located one mile north of the north city limits of Flint and passes through a well developed suburban area.

Within ten minutes after the storm struck, Rex Pemberton, Maintenance Engineer for the Genesee County Road Commission, whose home is located near the path of the tornado, was on his way to headquarters located on the south side of Flint. He was able to reach headquarters by radio and gave orders to call out all employees. Telephone service in the storm area, and to the north of the path of destruction, was impossible. Fortunately, one of the foremen, who lives in the northern part of the County, was listening to a radio broadcast when it was announced a storm had struck north of Flint. He went to his car and turned on the radio just in time to receive a call from the base station. He immediately got his crew together and was removing trees from blocked roads by 9:15 that evening.

The radio stations in Flint broadcast frequently a request that motorists stay out of the storm area. In a short time all direct routes to the storm area were blocked with sightseers. Two 4-lane highways and one 2-lane concrete road passing through the area, where the loss of life was greatest, were either blocked or so crowded they were of little use in rescue operations.

For some time information was meager and uncertain as to the exact location and extent of the damage. Added to this difficulty was the crowded condition of highways. To send out crews, under such conditions,

From "Highways and Byways," County Road Association of Michigan.



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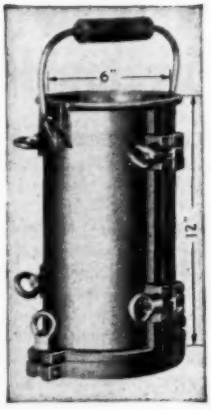
was taking a chance of their becoming stranded before reaching the section of roads closed by fallen trees. Accordingly, Pemberton decided to hold at headquarters the 14 crews that had reported until he could reconnoiter and determine where they were most urgently needed. Shortly after leaving headquarters, Pemberton found himself in a solid line of traffic moving toward the storm area. Pretty soon it stopped but he was able to reach an intersection and escape from the traffic jam. Then by travelling side roads he managed to get around to the north side of the disaster area where traffic was much lighter. Finding where the roads were blocked he then, by the use of the radio in his car, directed the crews standing by at headquarters where to go and by what route in order to escape traffic jams. By this method, all crews were soon on the job removing trees that were blocking traffic and delaying rescue operations.

By 11:30 that evening sufficient clearing of trees and debris had been accomplished to permit one-way traffic. Had it not been for radio, it can be safely stated that opening the roads would have been delayed until after daylight the following day. A former assistant maintenance engineer, who is very familiar with all roads in the County, stayed on duty all night at the base station directing crews from one job to another.

Although it cannot be definitely determined how many lives were saved as a result of getting the roads open in a relatively short time, permitting early evacuation and hospitalization of the injured, it is significant, however, that only one death resulted after the night of the storm. Such a record borders on the miraculous when you consider 700 people were hospitalized, many of whom turned out to be amputation cases.

Yes, radio played an important part in all phases of rescue work. The Genesee County Road Commission has 36 mobile units, all of which were used at one time or another. The state police were directed by radio. The activities of the sheriff's force were likewise directed by radio. All township fire departments were held in readiness and kept informed by their own radio hookup. One contractor used the radio with which he is equipped to direct his men during rescue operations. The "hams" were reported to have done very commendable work in answering inquiries from the outside. One operator reported standing by his set for 24 hours.

Obviously, a county road commission could not afford to purchase radio equipment in anticipation of a disaster, but the improved and accelerated service that can be given the public every day justifies the investment. Then, should a disaster ever occur, communication will be available when it is most needed.



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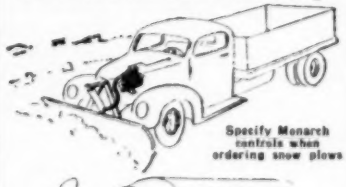

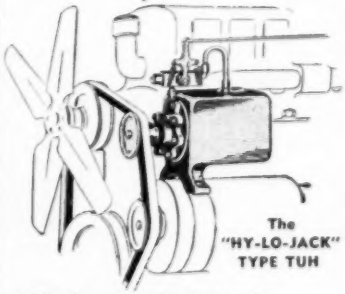

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You *know* that day after day, week after week, month after month, they will do *more* work with *less* down time at *lower* cost than any competitive units.

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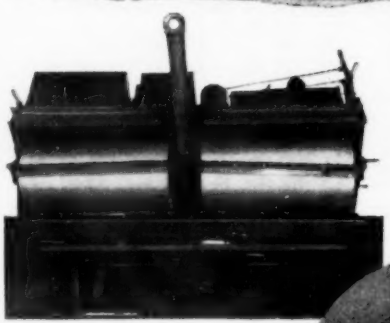
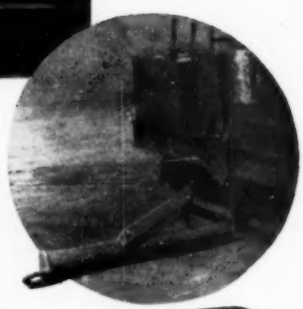


The underside of the Adnun Jr. Model 8 showing the Cutter Bar.



No trailer is needed for the Adnun Jr. The removable Trailer Hitch permits the Adnun Jr. to be lifted by the truck hoist and towed away.

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ADNUN JR MODEL 8

BLACK TOP PAVER

Bituminous ROADS AND STREETS

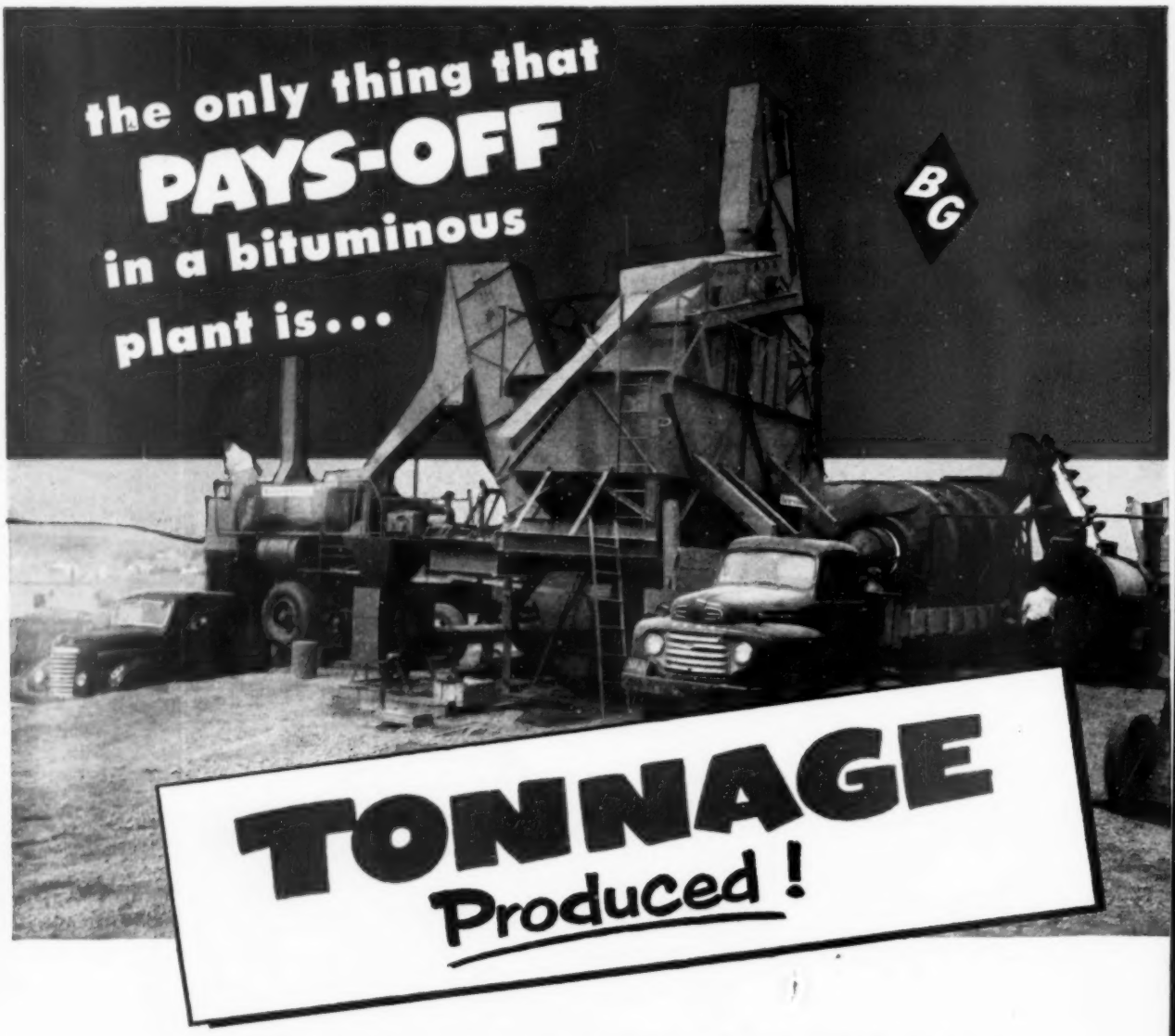
Cover Scene

Spreading crushed stone for penetration macadam base. Bituminous section of test pavement being constructed by the Indiana State Highway Commission as a section of arterial highway. (To be reviewed in a forthcoming issue of Roads and Streets.)

Published by Ellicott Publishing Company
22 West Maple Street, Chicago 10, Illinois

Bituminous Concrete Behavior in North Carolina
High Type Asphaltic Concrete in Duluth
How to Start a Driveway Business
H. C. Nevitt on Conservation

NOVEMBER, 1953



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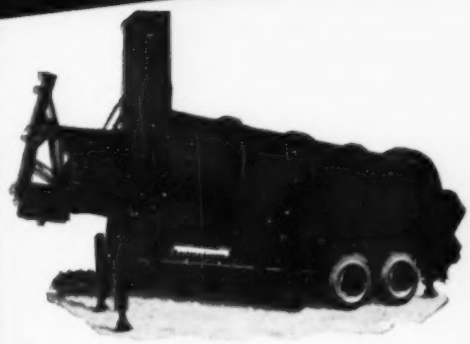

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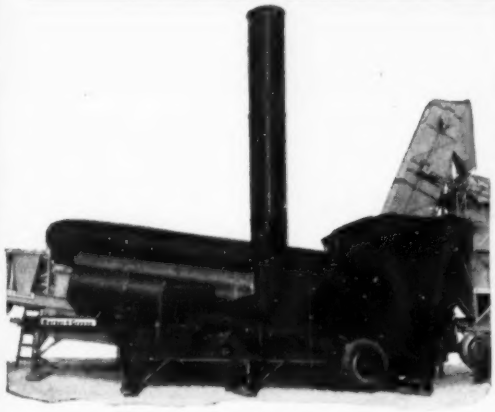

857 DUST COLLECTOR

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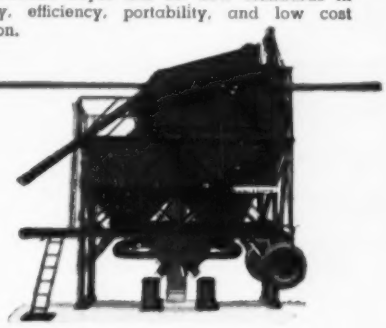

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★ Newly resurfaced First Street in downtown Duluth

High Type Asphaltic Concrete

Duluth's Answer for Rigorous Climate, Steep Grades

Like many other cities, Duluth has only begun to catch up with street resurfacing job, neglected during depression and War years. The author traces his city's unfolding postwar program.

By Arthur W. Tews, P.E.

City Engineer, City of Duluth, Minnesota

DULUTH'S postwar program for the rehabilitation of old streets calls for the use of high type asphaltic concrete.

A combination of circumstances, existing in the Zenith City during the middle 'Forties, brought about the culmination of a long-range, low-cost resurfacing program which, now in its fifth year, has proven its worth beyond a shadow of a doubt.

Duluth, like nearly all other Midwest cities on VJ Day, found itself bumping along over old, wornout streets, long neglected during the depression 'Thirties and the World War 'Forties. Situated at the Head of the Great Lakes, surrounded by iron, lumber, grain and shipping activity, its growth was rapid and its prosperity was ever increasing.

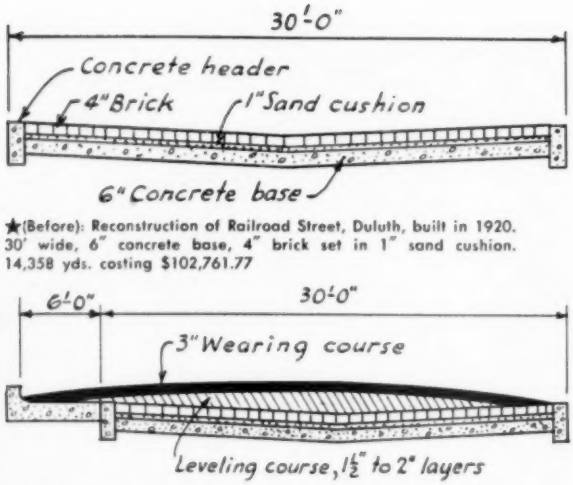
During the 'Twenties about $1,000,000 annually was spent for public improvements and street paving. When the depression came we found our streets new and in first class condition. Due to the aches and pains of the depression and the war, no thought was given to the maintenance and upkeep of our streets. With the elimination of the old street cars and the changeover to trolley and gas buses, many miles of rails were dug out and sold for scrap during the war years.

Then, after 15 years of meager maintenance, lack of new paving and surfacing, with the ever-increasing number of cars and trucks and heavy loads, our streets became shattered, pitted and worn.

In 1945 the Minnesota state highway department brought in a contractor to surface about 24 blocks of trunk highways inside the city limits. After the completion of this state job, the city awarded a contract to this same contractor for the surfacing of three blocks of city street on 21st Avenue West. This marked the beginning of the city's resurfacing program with asphaltic concrete. Since this meager beginning in 1945 we have resurfaced approximately 50 miles of streets and trunk highways at a cost of over $2,000,000.

Old Top Becomes New Base

The 21st Avenue West surfacing job was truly unique in several ways. Its primary purpose was to create a smooth surface to carry the entire West Duluth bus traffic to and from the main downtown area. With the elimination of street cars in the late 'Thirties, the city removed the four rails and repaved the 20-ft. area of sandstone cobbles which made up the original surface. This block paving was very poorly laid and was unbearably rough.



★(Before): Reconstruction of Railroad Street, Duluth, built in 1920. 30' wide, 6" concrete base, 4" brick set in 1" sand cushion. 14,358 yds. costing $102,761.77

★(After): Widened to 36' with 6" concrete base and surfaced with asphaltic concrete, 2" minimum thickness on sides, crowned to 6" in the center. There are 23 railroad crossings which service the docks on this 5,000 ft. street

Having a pavement with adequate thickness and strength, but lacking smoothness of surface, we were concerned only with a thickness of mat sufficient to create a good riding surface. Requiring minimum thickness was most fortunate because we had no public funds to pay for this job. The necessary money came from public subscription, amounting to $2,588.-08. A total of 328.5 tons was placed as a wearing course 1½ in. thick. The street was paved on October 16-17, 1945, when our Indian summer was at its best. No seal coat was placed until the following spring. A second seal coat was placed in 1951 by the city public works crew.

This street was converted into a state trunk route in 1952 and has been carrying additional trunk highway traffic for almost a year. Bids were opened July 10 to place a new wearing course this year.

Street Program Expands

In 1946 downtown First Street from Mesaba Avenue to First Avenue East was resurfaced. The old pavement placed in 1924 consisted of sheet asphalt, laid on a concrete base. This surface gave very poor service because of an overdose of portland cement mineral filler, producing a hard, brittle surface which continued to shrink, producing thousands of cracks. These spawled and crumbled, forcing maintenance patching and crack filling. This form of maintenance was required constantly and proved to be very costly.

This surfacing placed in 1946 consisted of asphaltic concrete using AC1, 70-100 penetration material and 100% crushed trap rock, mixed in a small continuous mix plant. 18,640 sq. yd. was placed, costing $27,331.96, or $1.46 per sq. yd.

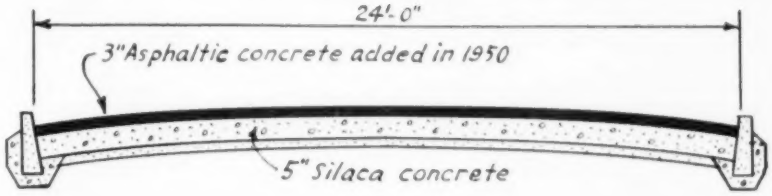
During the 1947 paving season the Council ordered the surfacing of all the downtown avenues in the main business district. This project included 31 blocks of resurfacing, or 35,386 sq. yd., and cost $41,916.60, or $1.18 per sq. yd.

The successful contractor brought in an old batch plant which had given good wartime service on airports. Following the completion of this season's work the contractor started rebuilding and overhauling this plant. Before he became completely satisfied with this plant he found himself rebuilding

★ During and after modernization of Mesaba Avenue in Duluth (1951-52). Asphaltic concrete placed in 2-in. mat on a 12½% grade; 3-in. mixed prime base supported by a stabilized pit run gravel fill

★ (Before): Hawthorne Road, Duluth. Originally paved in 1913, 24 ft. wide, with silica concrete (1 part cement, 2 parts clean sand, 5 parts Kettle River sandstone). Sandstone curb set in concrete

★ (After): Surfaced in 1950 with asphaltic concrete, highest type 100% crushed trap course aggregate. 7886 sq. yd. Cost $15,614.92.



it almost from top to bottom. The overhauling job was so complete he is still using the plant today and it is giving first class service.

Steep Hills Involved

Our downtown avenues were paved shortly after 1900, consisting of a 5-in. concrete base with sandstone cobblestone surface set on a sand cushion. The grades existing on these avenues are all Bureau of Public Roads nightmares, running from eight to eleven per cent.

The contractor completed the placing of the asphalt mat in the late fall of 1947 and it was used this way during the winter. A heavy seal coat was placed early in 1948 using about 0.3 gal. per sq. yd. of RC3 and about 35 lb. per sq. yd. of washed sand. The sand was thoroughly rolled by using a pneumatic tired roller pulled with a heavy farm tractor. This method of rolling proved very effective considering the steepness of the grades, which are a real hazard to the use of any steel wheeled roller.

During the winter months the use of abrasives, sand and salt are necessary constantly in Duluth. The scrubbing of the pavement surfaces by trucks, buses and cars using snow tires, chains and automatic wheel sanders is tremendous. Many intersections and uphill lanes require a new seal coat every year. Experience over the years has shown us that the heaviest types of asphalt such as RC3 and asphalt cement are much more effective and durable under our particular kind of traffic.

We budgeted considerable quantities of seal coating again this year. Our plan is to place a thin layer of pre-coated aggregate with a tamping finishing machine using pea gravel and asphaltic cement. This method of placing a seal coat should give us not only a durable driving surface, but a smooth, level surface which is not now attainable by the spray type method of seal coating.

Construction during 1948 was largely on Trunk Highways within the city limits.

New Resurfacing Era

1949 brought the beginning of an extensive resurfacing era which probably will run many more years. The 1949 state legislature passed a bill which provided the city of Duluth and all other cities in St. Louis County with a yearly sum of $200,000 collected from Duluth tax payers for the road and bridge fund, this amount to be matched with funds assessed against the adjoining property owners and city funds for intersections and storm sewers.

The law was passed as a permanent Act and needs no renewal. It runs indefinitely, or until such time as it is repealed.

In 1949 the St. Louis County Board supplied, on a voluntary basis, $47,000, which was matched with city money. Under this program a total of 27,947 sq. yd. of asphaltic concrete was placed, costing $51,837, or $1.85 per sq. yd.

In 1950, the first year of construction under the county aid law, eleven resurfacing jobs were completed. Asphaltic concrete was used in surfacing 126,256 sq. yd., costing $213,803, or $1.69 a sq. yd.

During 1951 five projects were completed using asphaltic concrete for surfacing over old pavements, a total of 97,481 sq. yd. costing $181,876, or $1.86 per sq. yd.

Ten projects were built in 1952 totalling 65,961 sq. yd. of surfacing at $138,290, or $2.09 per sq. yd.

The 1953 construction program calls for ten resurfacing jobs involving approximately 125,000 sq. yd. of asphaltic concrete costing approximately $250,000.

During the years 1950-51-52, with estimated costs for 1953 added, $800,000 was supplied by the St. Louis County Board and these funds were matched with city and assessment money in an equal amount in accordance with a formula set up for arterial street construction.

A variety of jobs is included in this construction and reconstruction program. Most of the available funds were spent for resurfacing wornout pavements including one-course concrete, brick, sheet asphalt, bitulithic and warrenite asphalts, cobblestone, road oil and plain gravel. Several streets were widened with concrete curb and gutter and concrete base and then surfaced with asphaltic concrete. There were a number of new concrete pavements placed where the old streets were incapable of supporting asphaltic pavements.

As mentioned in the opening para-

Comment on Steep Streets in Duluth

Our job of resurfacing the great variety of streets and avenues carrying grades from 0 to 27% presents many special problems. We have developed and put into practice a revolutionary high crown on our city streets which has performed miracles for the Duluth driver.

We vary our mix designs and surface finish on steep streets and avenues. The amount of asphalt added varies with the steepness of the grade. As the gradient increases the amount of asphalt decreases. This, we think, decreases or prevents pushing, creeping or washboarding. In fact we have had absolutely no movement in our mats where asphaltic cement was used in our mix.

In our seal coating operation we have adopted the use of RCS 1 & 2 (rapid cure special) on all our high-type bituminous mats. On the flat grades we can use less bitumen—approximately 0.20 per sq. yd. with 30 lb. of washed sand, ¼-in. chips or pea gravel. As the gradient increases we increase our bitumen content up to 0.3 gal. per sq. yd. with up to 40 lb. of pea gravel. We apply extensive rolling with 10 or 12-ton 3-wheel rollers, and keep the traffic off new seal coats up to 24 hours. Many perfect armour coated bituminous streets have resulted where we used pea gravel and a maximum of bitumen.

Arthur W. Tews, P.E.

graph, paving specifications call for the highest type asphaltic concrete, Minnesota Highway Department specification 2351, which includes 100% crushed course aggregate, ¾ in. maximum size, properly mixed in a batch type plant with paving sand and mineral filler mixed with asphaltic cement penetration, 120-150 in the amount of 5% to 6.2%.

City-wide planning of reconstruction takes in a variety of streets, avenues, boulevards and parkways. Equal consideration is given to all arterial streets, no matter how steep or flat the grade. Nearly all the avenues plotted perpendicular to the shoreline of Lake Superior vary from 8% to 27%.

Mixed Prime Base

Last summer we paved with asphaltic concrete on a 12½% grade on Mesaba Avenue from Fifth Street to Seventh Street. This project called for the revision in alignment to eliminate three sharp turns. A 2-in. asphaltic concrete mat was placed on a 3-in. mixed prime base laid with a tamping paver and rolled with a three wheel 12 ton roller. A new contract calls for the completion of this job by placing concrete curbs and gutters, new sidewalks and roadway beautification.

Speaking about steep grades, the City Council has just ordered the surfacing of West Third Street from Piedmont Avenue to Mesaba Avenue, where we encounter a 16% grade from Piedmont Avenue easterly over the renowned Point of Rocks, which has separated East Duluth from West Duluth for all these many years. To date there has been a shortage of funds necessary to cut a second thoroughfare over this rock formation with grades flat enough to qualify under Bureau of Public Roads standards.

To date several million dollars have been spent to rehabilitate our extensive street system. Actually we only "scratched the surface." It will take many millions more to place an acceptable surface on the hundreds of miles of old, rough and obsolete streets, now being used within our city limits.

Steep uphill "trap" for run-a-way trucks

The New Mexico state highway department has incorporated a unique design feature in the Raton Pass grade, north of Raton Pass. It consists of a "trap" located about 1,000 ft. from the bottom of the long grade, for helping the driver get control of any truck that might get out of hand on the grade.

The device consists of a lead-off from the 6 per cent downward grade, leveling off and climbing to a 32 per cent adverse grade in a distance of 600 feet. The surface is not paved.

The trap as first constructed was located off of a straightway in such a manner that its sharp turn made it hazardous for a speeding truck to use. However, according to chief highway engineer C. O. Erwin, a semi-trailer did use the trap without overturning. Following this experience the present trap was built leading off a curve in the main roadway. It will protect citizens from Raton from runaways which occasionally have sped down this town's main street fortunately without fatalities to date.

A light wire barrier fence prevents motors from entering but will not impede a truck in emergency.

Rhode Island prepares engineering soil map

Aerial photography, with stereoscopic analysis, available agricultural maps and data, federal topographic maps, pertinent geologic data, and other information are being used in the preparation of an engineering soil map of the State of Rhode Island. When completed, this research will provide six maps and a bulletin covering all available information on soil conditions both at and below ground surface. The work, sponsored jointly by U. S. Bureau of Public Roads and the Rhode Island Department of Public Works, is being conducted by the engineering experiment station of the Rhode Island State University. It is expected that the entire project will be completed late in the year 1954.

★ Runaway trucks on the long grade entering Raton, N. Mex., can be shunted up this steep "trap"

NORTH CAROLINA STUDIES

Behavior of Bituminous Pavements

Improvement in design for heavy traffic is sought through a statewide study of pavement service. A special experimental project is also described, designed to correct serious defects on a bituminous overlay project.

C. E. Proudley
Chief Materials Engineer
North Carolina State Highway and
Public Works Commission

INCREASE in volume and weight of traffic has had destructive effects upon North Carolina's pavements just as in all other parts of the country. Some failures have been so serious as to require reconstruction within a matter of months and in other cases maintenance costs have been abnormally high. Such conditions have prompted the commission's Research Department and the Bituminous Engineer to cooperate in conducting studies of all bituminous pavements, both good and bad, for the purpose of determining the criteria for design of bituminous paving mixtures and the construction methods.

Almost five years ago the Research Laboratory began a study of the various laboratory methods of designing the hot plant mix, beginning with the Hubbard-Field apparatus for sand-asphalt followed by a modified Hubbard-Field test for bituminous concrete in which a 6-in. diameter specimen was used. The Marshall apparatus was used in parallel studies of the design of mixtures for optimum asphalt content. Finally, the unconfined compression test method was developed following suggestions of the U. S. Bureau of Public Roads in the design of the vibrating table for securing the densest combination of proposed aggregates. The Model N-50 Mixer manufactured by the Hobart Manufacturing Company is used with modified mixing bowl and paddles, and other refinements of curing and testing apparatus, to secure maximum uniformity of laboratory procedure.

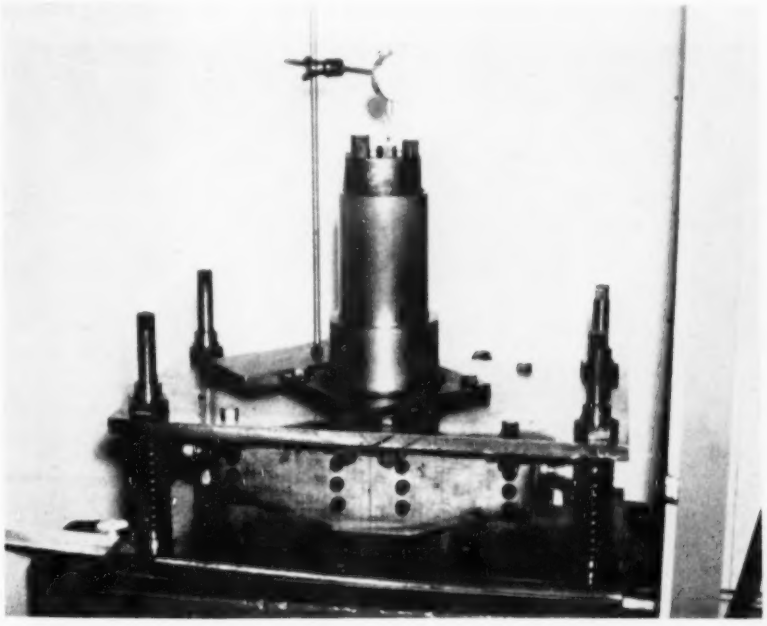
Density determinations are of first importance in the laboratory design and it is the practice in North Carolina, as in most other states, to endeavor to obtain a minimum void content of 15 to 20 per cent through aggregate gradation; the denser the aggregate the greater the strength or stability to be expected. Asphalt is added to the extent necessary to leave approximately 5 per cent voids in the final mix when compressed as it is intended to be compacted in the road. Under no circumstances should this value be less than 3 per cent and it is desirable, in order to assure resistance to percolation of water and the effects of weather, that the value be not greater than 6 per cent.

Old Pavement Samples

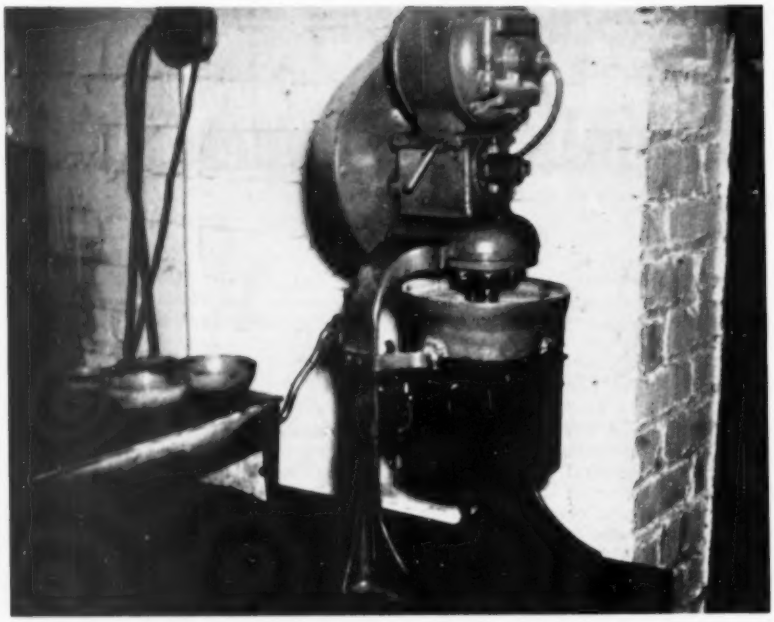
These density criteria are used in judging the quality of the road samples taken in conjunction with the studies of old pavements. It has been found that most of the failures have been the result of the presence of an excess of asphalt as indicated by the absence of a safe amount of air voids. Greater detail of the method and criteria are given in "The Design of Bituminous Pavements in North Carolina" by H. Fred Waller, Jr., Laboratory Supervisor, North Carolina State Highway and Public Works Commission, given at the annual meeting of the Southeastern Association of State Highway Officials in Asheville, N. C., October 1, 1953.

Bituminous paving on the primary highways of North Carolina placed since 1946 has been examined in considerable detail by both field and laboratory tests. A road-roughness indicator is run over the pavements periodically for an indication of progressive distortion. This should tie in with stability measurements in the laboratory provided the pavement as laid has the same composition and density as the design specimens made in the laboratory. Density of traffic on the pavement will affect the time required for the distortion, if any, to take place. Traffic surveys are being made continuously by the Division of Planning and Statistics and these data are always reported with studies of pavement behavior.

Skid resistance of pavements is measured by the skidding distance of a passenger car conducted in a manner similar to the method reported



★ The densest combination of the mineral aggregates proposed for the bituminous concrete mix is determined with a vibratng table on which the double-plunger mold is fastened. The dial at the top is used after vibration to measure the volume of the compacted aggregates.



★ Uniform mixing of every batch of bituminous concrete is secured by using a (Model N-50 Hobart) food mixer modified for this purpose.

by the U. S. Bureau of Public Roads in the June, 1953, issue of *Public Roads*.* These tests are made only in those cases where there is some question as to the slipperiness of the pavement.

* "Breaking Distances of Vehicles from High Speed and Tests of Friction Coefficients," by O. K. Normann, Chief of Traffic Operations Section, Highway Transport Research Branch, U. S. Bureau of Public Roads.

All Types Being Studied

A continuing study has been in progress since 1951 of bituminous concrete pavements on old portland cement concrete pavements, on old bituminous pavements such as surface treatments, sand asphalts, both plant mixed and mixed-in-place, and on other types of bases. Samples are cut from the pavement and the condition of the bottom of the surface course or binder course noted for the presence of moisture, stripping of the aggregates and adhesion to the old base. The samples are taken to the laboratory for analysis to determine grading of the aggregate, percentage of asphalt, density, and in some instances the aging or hardening of the asphalt when availability of records permits. The first report was made by the writer in 1952 in a paper on "Experience with Sand and Gravel in Bituminous Paving Mixtures" at the 36th Annual Convention of the National Sand and Gravel Association. Additional examinations have been made since that time and progress reports are in preparation.

One of the most rapid and serious failures took place on US-301 north of Fayetteville, N. C. It was necessary to scrape off some of the surfacing which had been placed on about 19 miles of concrete pavement built in 1926. This is one of the most heavily travelled routes through North Carolina. The bituminous resurfacing which failed by shoving and stripping after less than 17 months of service was not designed by the laboratory; and except for the excessive amount of moisture between the old concrete pavement and the new bituminous concrete surfacing which caused stripping of the aggregate, the cause of the failure was not readily apparent. It is thought that the type of aggregates used were such as to make the percentage of asphalt a very critical value and that because of insufficient control of the uniformity of the mixture produced by the plant, many areas of the pavement were in the unstable range of composition although the average for the job did not appear to be so bad as to warrant the extensive failures which occurred.

★ The hot bituminous paving mixture is compressed to the desired density in a portable hydraulic press.

Special Experimental Section

At the request of the Division Engineer responsible for this road, the laboratory outlined an experiment in which three types of coarse aggregate were used: crushed granite, crushed gravel (about 50% crushed particles) and uncrushed gravel. Mixtures were designed with all the care that the laboratory could command. The laboratory personnel supplemented the inspectors assigned to the job and every precaution was taken to secure a reasonably uniform product from the not-too-well-equipped plant that would conform to the laboratory designs. Numerous samples were taken from the plant and the roadway during construction and analyzed in the laboratory with the location of every batch placed in the road accurately identified.

Test sections each 1,000-ft. long were placed lane-at-a-time and the only intentional difference between the lanes was the type of tack coat used: RC-2 cutback asphalt and AP-3

(Continued on page 130)

No repairs during two years of service..

Not only does an Etnyre "Black-Topper" handle routine jobs well, but it takes special jobs in stride, according to Thomas W. Biddison, Treasurer, Better Roads Corporation of Baltimore. Recently, the distributor was used on a ramp in an outdoor theater, avoiding hand work. And the continuous processing of the penetration macadam road (shown above) was handled as a matter of course.

Saving of time and labor, faster heating of bituminous materials, rapid changeover to other types of materials, easier loading and draining, more even distribution are some of the Etnyre features appealing to Mr. Biddison. His "Black-Topper" has handled all types of road mixes on level and rolling terrain over a period of two years without repair.

Ernest Shipley, the operator, likes the low center of gravity on the Etnyre which makes the truck easier to handle, more flexible in operation. And he appreciates the easy starting motor, even after long periods of inactivity.

These are typical reactions from "Black-Topper" owners and operators ... facts based upon operating experience. You can get the same benefits from your investment in an Etnyre. For latest data and prices, see your Etnyre Dealer or write E. D. Etnyre & Co., Oregon, Illinois.

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BITUMINOUS DISTRIBUTORS

When specifications are tough...

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Bottom deck feed adds extra capacity—PIONEER'S famous portable Duplex Plants, such as the 46VE, are now available in 7 different sizes. Each offers these exclusive PIONEER features:

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helps you meet them

How Parsons & Fife overcame difficult problem

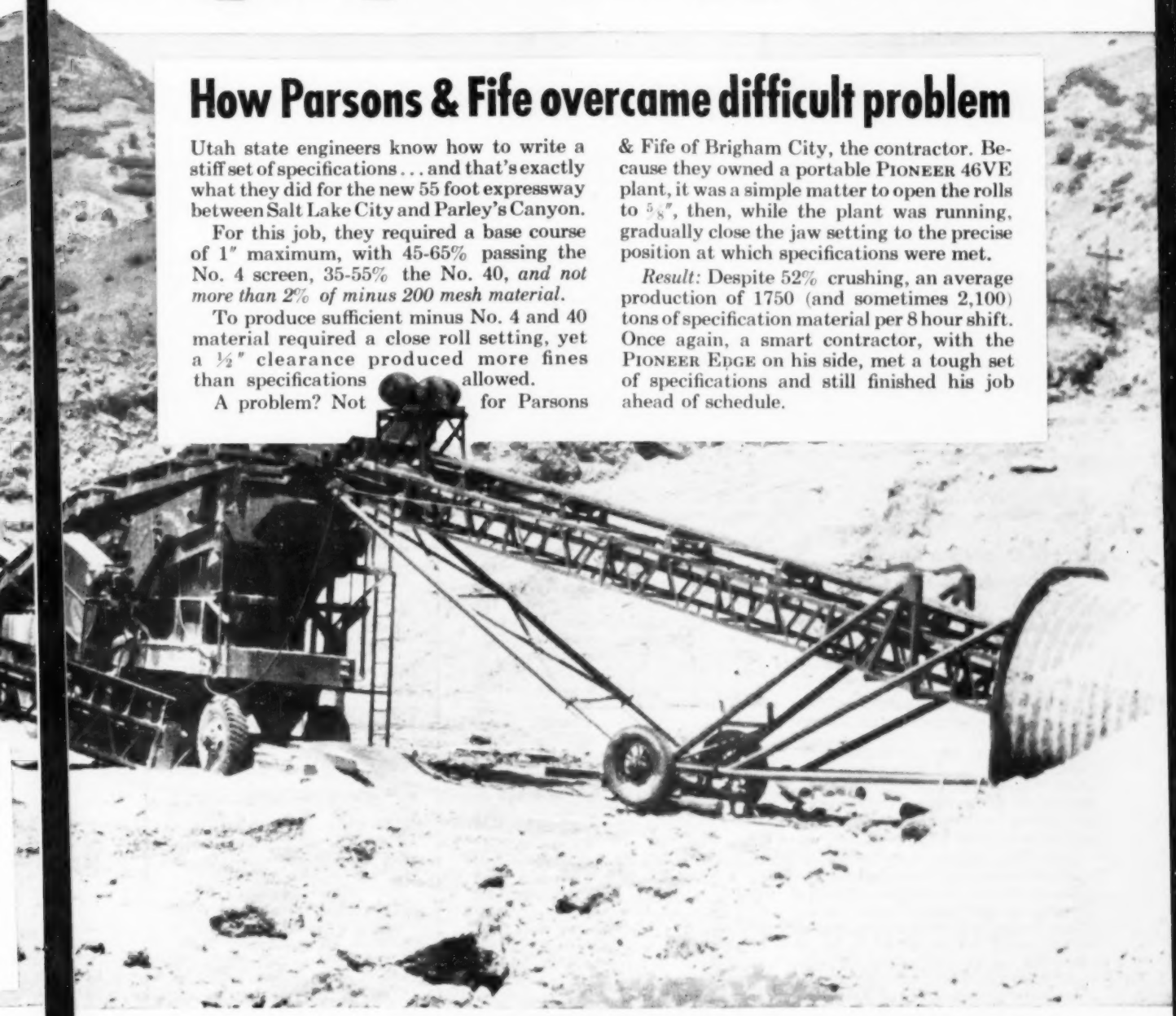
Utah state engineers know how to write a stiff set of specifications . . . and that's exactly what they did for the new 55 foot expressway between Salt Lake City and Parley's Canyon.

For this job, they required a base course of 1" maximum, with 45-65% passing the No. 4 screen, 35-55% the No. 40, *and not more than 2% of minus 200 mesh material.*

To produce sufficient minus No. 4 and 40 material required a close roll setting, yet a ½" clearance produced more fines than specifications allowed.

A problem? Not for Parsons & Fife of Brigham City, the contractor. Because they owned a portable PIONEER 46VE plant, it was a simple matter to open the rolls to ⅝", then, while the plant was running, gradually close the jaw setting to the precise position at which specifications were met.

Result: Despite 52% crushing, an average production of 1750 (and sometimes 2,100) tons of specification material per 8 hour shift. Once again, a smart contractor, with the PIONEER EDGE on his side, met a tough set of specifications and still finished his job ahead of schedule.



Have the Pioneer Edge on your side—Parsons & Fife are typical of hundreds of experienced contractors who have learned that PIONEER equipment helps them produce the extra tons needed to gain a competitive advantage when bidding is close.

What are your needs? Check the coupon for details, specifications, and information on PIONEER equipment that will help *you* cut costs on your next job.

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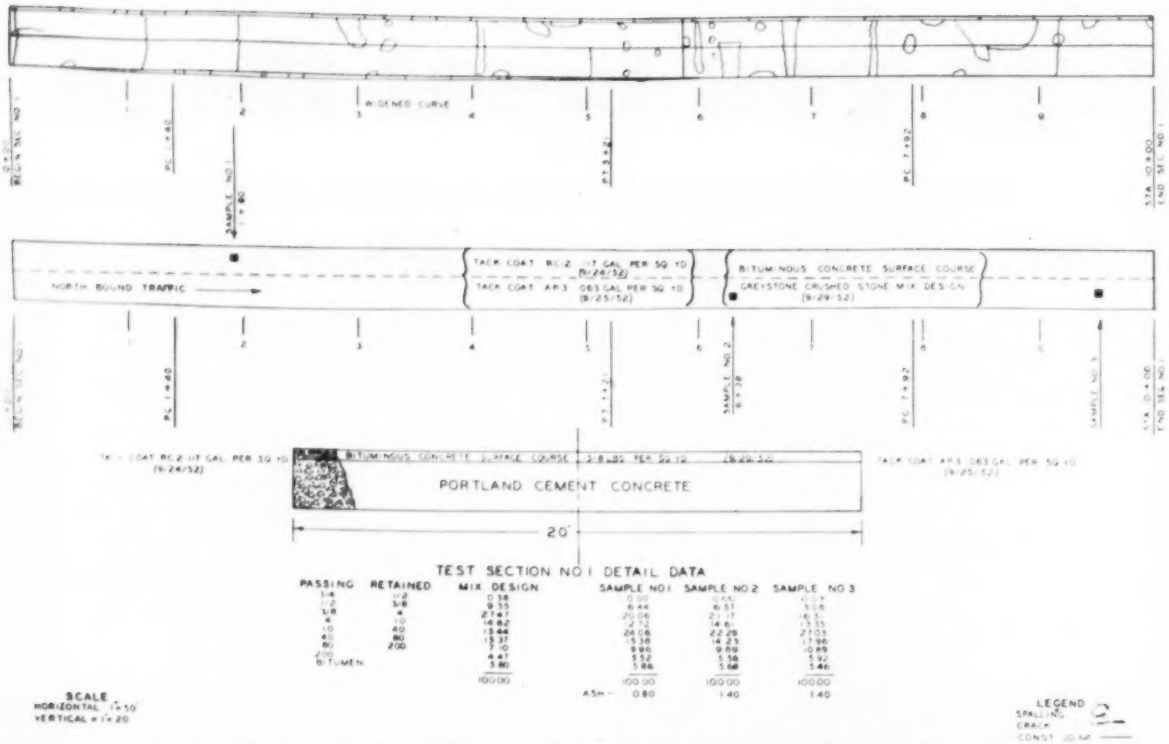

★ Straight line diagrams illustrate the condition of the concrete pavement before placing the experimental sections of bituminous surfacing and the pertinent data for each of the sections as constructed. This diagram is for Section 1.

North Carolina studies

(Continued from page 126)

hot asphalt. The first group of three sections differed in character of coarse aggregate but all were 150 lb. per sq. yd. of bituminous concrete wearing surface with no binder course.

The next group of three sections differing in aggregates was placed with 150 lb. of bituminous concrete binder course, two types of tack coat, and 150 lb. of bituminous concrete wearing surface of the same design as for the first three sections. Designs of the next five sections are best described by the table below.

Four more test sections were constructed using various types of surface treatments over the unstable bituminous concrete surfacing, in an effort to develop some cheap means of salvaging the pavement without removing the unstable material. Results have not been encouraging although the sections are still in service.

During the construction of the bituminous concrete test sections it became increasingly evident that one of the most essential features of the work was the securing of satisfactory rolling or compaction of the newly laid binder and surface courses. In recent months the Research Department has been actively accumulating data on effectiveness of compaction methods. Observers with stopwatches, thermometers, chalk and tapelines have recorded the temperatures of the materials at each stage of placing and rolling, the speed of the rollers, weight, number of passes and the density of the pavement developed by various combinations of these conditions. After another construction season it is hoped that sufficient data will have been acquired to permit writing more accurately descriptive specifications for this phase of hot mix bituminous pavement work, to assure complete benefits from the earlier stages of mix design and plant control.

Tack Coat	Binder Course	Asphalt	Wearing Surface
None	65 lb. of 1" crushed granite single surface treatment	AE-3 .613 gal.	105 lb. bituminous concrete crushed granite aggregate
None	64 lb. of 1" uncrushed gravel single surface treatment	AE-3 .645 gal.	103 lb. bituminous concrete uncrushed gravel
None	64 lb. of uncrushed gravel single surface treatment	AE-3 .589 gal.	165 lb. sand asphalt using AP-5
None	65 lb. of crushed granite single surface treatment	AE-3 .633 gal.	165 lb. sand asphalt using AP-5
.10 gal. AP-5 at 400 F.	One course of 170 lb. sand asphalt		Sealed 2 weeks later with 43 lb of ½-in. seal stone crushed granite, using .506 gal. AE-3.

Over-Weight Asphalt Distributors a Problem

A memorandum to members from the Virginia Road Builders Association notes the following in reference to permits to operate heavy asphalt distributors under a new state law.

"Under the law it is not now possible to purchase licenses for any two axle truck in excess of 24,000 lb. This will make the 1,000-gal. distributor, loaded with asphalt, about 4,000 lb. overweight.

"We can secure blanket permits for the operation of these vehicles with gross weights of 28,000 lb., provided they do not exceed the axle loading specified for the road of either 16,000 or 18,000 lb. Contractors desiring such permits must furnish the make of the truck and license numbers for each vehicle. It will be necessary to carry these permits in the truck at all times while operating it loaded and a separate permit will be needed for each vehicle.

"Not all distributors are overweight under the new law. The weight, of course, depends upon the truck on which the unit is mounted."

VIEWS AND COMMENTS

By H. G. Nevitt

Conservation is Essential

Justifiable concern is being shown over our serious loss of topsoil in this country. We have another consumption of raw material which is perhaps equally serious at present, though limited in concern largely to highway engineers and the construction industry. This is the rapid using up of our available aggregates in many areas of the United States. This is occurring at an alarming rate. Furthermore if other factors not so obvious are brought in, even greater concern is indicated. Not enough is being done to offset this heavy withdrawal of available aggregate supplies; the subject would therefore seem to merit discussion.

There are three factors that should accentuate the alarm over this high rate of use.

One is that if the depletion rate is calculated on the basis of future needs for our obviously greatly increased highway program, instead of against present or past withdrawals, the scarcity of good aggregates appears far greater.

Secondly, we must consider the value of this aggregate rather than its procurement cost. At the present time economic comparisons are made against the use of nearby aggregate on the basis of the cost of obtaining the deposits and utilizing them in the road. Instead of these costs, which may be quite low at present, the potential value of this aggregate should be the figure used. There are many cases today where the comparison of doing the job using gravel against methods which tend to conserve it, such as through a bituminous surface rather than a gravel road, is based on these procurement costs rather than value. For example, a $2.00 per ton equivalent gravel cost is turned down as too high, since the actual available material can be placed on the road at something like $1.00 per ton, ignoring the fact that in a relatively few years all further aggregate will be costing at least $3.00 per ton and therefore the present deposits represent a value more nearly at this level than at the $1.00 per ton actual current cost.

Finally, we must consider the need for sealcoat aggregate in the future, since there will be no ordinary replacement for products of this type. As we stress on every occasion, the inherent demands for a mat of optimum structural characteristics are quite contradictory in the great majority of cases to the requirement for a suitable surface from the standpoints of skid resistance, luminosity and permanence. Therefore, better engineering as well as better economics call for designing the mat for structural strength and providing the needed surface characteristics through a sealcoat.

Seal Coat Aggregates

Obviously there is no way of getting these surface characteristics through soil stabilization or other treatment of the material in place. Only the aggregates now being used up at a rapid rate offer a logical source of such sealcoat material; and, unfortunately, the usuable fractions are usually only a small proportion of the total available aggregate.

It is therefore evident that even today all aggregate being used to construct bases or mats should first be screened in areas of potential shortage and the desirable fraction for sealcoating—roughly from ⅛ to ⅜ inches in size—taken out and stockpiled for future use. As our traffic loads and traffic speeds increase, it will be more and more necessary to resort to regular and not too long separated sealcoat treatments if we are to maintain a safe driving surface. In view of the past record it is perhaps idle to expect that foresight in this matter of conserving sealcoat aggregates will be exercised; but we prophesy that in a few years failure to do so will be bitterly regretted by highway administrators and engineers in many sections of this country.

Three Approaches

This matter of replacing, or minimizing the need for, locally available and cheaply obtained gravels and other aggregates has of course not gone without attention. A great deal of ingenuity has been shown in proposing ways to do so, and from the standpoint of the technology involved a great deal of progress has been made. However, it falls short of the demands resulting from this using up of our convenient aggregate supplies.

Most of these substitute procedures are classifiable under the general term "soil stabilization"—although actually the potentialities have so expanded that the general term should perhaps be instead "soil protection," implying that such protection may come from either within the soil mass or without. They all involve the utilization of the soils in place on the roadway, or nearby materials which ordinarily would not be classified as usable but would instead merely serve as subgrades or subfoundation courses.

Generally speaking such soils can be utilized through three different approaches. The first is to make what constitutes essentially a new material by the addition of other products. The second is to not modify the basic characteristics but neutralize or control deteriorating influences. The third is to protect the soil externally from these deteriorating influences. Each of these three approaches merits some discussion.

The first, that of modified soils, is the one which has been probably re-

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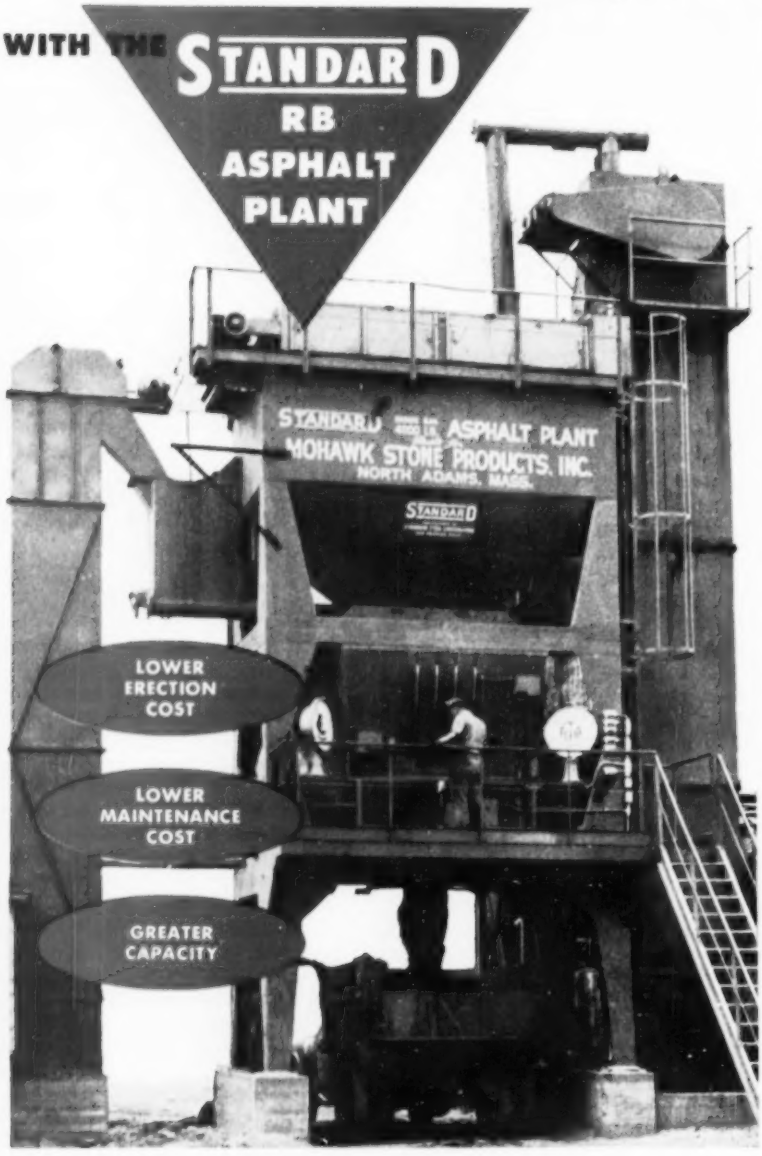

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sorted to the most. In this the additive or product brought in, when mixed with the soil, results in an essentially new material with its own special properties. Typical instances are mechanical stabilization, where the soil properties are changed by some outside aggregate being worked in, stabilization with portland cement (which gives essentially a very low strength rigid pavement), and stabilization of sands with bituminous materials (where the cohesion lacking in the sand is supplied by the bitumen).

It is obvious that in each case the design must be in accord with the properties of the new material formed. For example, in a portland cement stabilization job the conditions must either suit the construction of a rigid type of pavement or the design must be strong enough to withstand any difficulties resulting from unfavorable conditions. In the case of a sand stabilization job with bitumen, where a relatively low bitumen content is used in order to give high stability as well as economy, the abrading and other characteristics of such a flexible mat must be kept in mind and a suitable protective layer placed over it. In brief, the design must stand on its own feet and suit the structural characteristics of the modified soil as determined by actual tests.

Aspects of Stabilization

In the second approach the soil is stabilized rather than modified. In this some outside agent is used to control any tendency to eliminate the inherently good structural properties of the soil. For example, it may be kept at its optimum moisture content through the use of a waterproofing bitumen or other chemical giving similar results. Since the dry or equilibrium soil structural properties are essentially unchanged by this treatment, the design must suit these properties.

It is obviously wrong to expect a soil layer of inherently low bearing strength to carry a heavy load simply because a stabilization treatment has been resorted to. We can recall one recommendation in the past where a 6-in. stabilized soil layer was proposed in lieu of the currently used gravel foundation amounting to some 10 inches or more in depth. To the question why the thickness of the foundation layer was to be so greatly reduced, the answer was that this was essential to favorable economics. Obviously such a job was doomed to failure, since the stabilized soil layer should certainly have been at least as thick as the corresponding aggregate

foundation and perhaps of even greater thickness. In such cases (provided the economics reflect values rather than current costs), soil stabilization is evidently not the proper procedure. The designer should recognize this rather than jeopardize the structure by modifying the desired quantities to suit the competitive economic needs.

The third approach might be described as protected soils, rather than modified or stabilized. In this method, the deteriorating influence, usually water, is kept away from the soil mass so that its suitable bearing power at optimum moisture is retained despite varying climatic conditions. This method has much promise; but to assure success in its use some understanding of the actual situation in such protected soil layers is essential.

Waterproofing Films

The usual construction procedure is to place a protecting and waterproofing film of asphalt all around the supporting soil mass, the latter being of sufficient thickness and with a proper load distributing layer above it to satisfactorily support the anticipated load. The basic idea is that if the soil mass is at the correct moisture content at the time of construction, with the desired structural properties, this waterproofing film around it will insure that these remain indefinitely. Actually this assumption may not be exactly correct.

It is true that waterproofing films of asphalt or other protective products of this general type do resist the passage of moisture. This resistance under ideal conditions in a thick film is extremely high, although in theory all these materials do let a very small amount of moisture in the form of vapor pass through them in time. In practice, it is impossible to produce an ideal layer such as described. In stead there will be a large number of very minute imperfections, constituting holes through which moisture vapor can pass into the soil mass. This is true of common protective wraps such as cellophane, waxed paper and other products used in packaging, and is even more true of a bituminous layer constructed in the field unless the job is done under such unusual conditions of care that it could not be duplicated in routine practice.

The water-proofing layer will therefore function merely as a considerable retardant to vapor transmission rather than as a complete sealing medium. This under proper circumstances is entirely satisfactory. If the climatic changes are transmitted to the interior mass so slowly that the trend is averaged out—and primarily only the average climatic conditions from the standpoint of moisture content is encountered in the soil mass—everything will be all right, provided this average climatic condition corresponds to the optimum moisture content or is within the tolerance range of soil moisture content.

If, however, the average condition corresponds to a higher moisture content, then this soil will ultimately lose its supporting value and the structure will fail—even though it may take several years. It is evident that in relatively dry climates, such as the southwest, this method offers great promise, as the average climatic conditions will undoubtedly be favorable. They likewise will probably suit it throughout the great majority of this country, perhaps even the entire United States. However, we are confident that there will be some areas where this method can not be used because the average moisture will be such as to ultimately result in excessive moisture content in the soil mass. Many more data than are presently available on characteristic construction of this type are needed to predict the limitations of this approach. However, the method offers so much promise in such a large proportion of our country it deserves far more attention and trial than so far has been given it.

Which Approach Best?

The obvious question is which of these methods should be used? There is no rule. Each individual situation must be analyzed for the possibilities that might have promise with it. After all designs practicable from an engineering standpoint have been worked out, the choice between them will essentially be on an economic basis. Of course it is essential that values rather than current costs be utilized in such a comparison.

Certain conclusions seem obvious from this discussion. The first is that soil stabilization involves a careful engineering analysis. There is no magic wand by which some arbitrary rules can be followed to produce a satisfactory job for any particular purpose. The considerable variation inherent in the usual highway picture is accentuated by the possibilities in this particular approach. Second, it is likewise evident that design and construction to suit the particular local conditions is an essential feature in a proper stabilization job.

These two conclusions spell trouble —something the highway engineer already has plenty of, and, being human, would like to dispense with to the extent possible. However, the conservation situation is such that neither the highway administrator nor the design engineer can avoid his obvious duty in this field. We must have greater analysis and investigation of these various possible ways of utilizing local soils. We must have more exploration in the field of the proposed methods, and determine the facts. This is true in areas where there is no soil stabilization program to speak of, and likewise where certain well established methods are in use but there has been reluctance to attempt to extend them or to try other methods. This is particularly the case with soils which do not fit the routine procedures currently used.

Our aggregates are steadily going in many areas; we must not wait to lock the stable until the horse is gone. If a greatly accelerated program of study and trial is adopted it seems certain that we will in due course have better and cheaper stabilization jobs; and that we can get far more benefit from such materials as we have now available than if the current use of aggregates, particularly in gravel road construction, is continued without thought of the future.

Bituminous highway and roofing standards

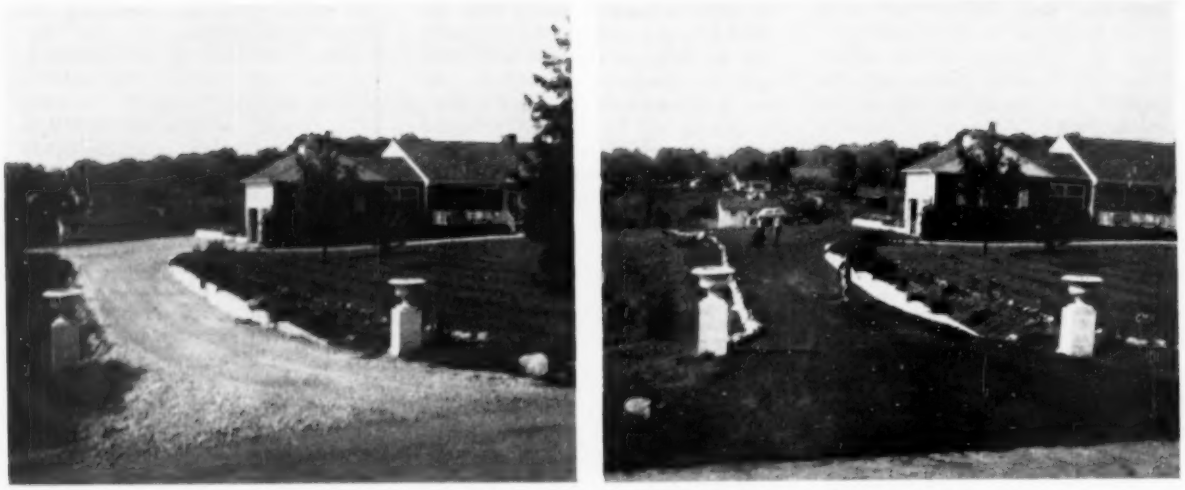
The third edition of the compilation, ASTM Standards on Bituminous Materials for Highway Construction, Waterproofing, and Roofing, is now available, revised and expanded to include 105 specifications, test methods, recommended practices, and definitions of terms.

Sponsored jointly by Committee D-4 on Road and Paving Materials, and Committee D-8 on Bituminous Waterproofing and Roofing Materials, the compilation also includes standards covering creosote materials which are under the jurisdiction of Committee D-7 on Wood but are directly related to the construction field.

Appendices in this publication include Proposed Methods of Test for Flash Point of Volatile Solvents by the Tag Open-Cup Apparatus; for Water in Petroleum and Bituminous Products; and Stripping Test for Bituminous-Aggregate Mixtures.

This compilation, bound in heavy paper cover, totals 368 pages. Copies priced at $3.50 each ($2.65 to ASTM members) can be obtained from ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa.

• **Dr. Arthur B. Cleaves,** recently geologist with the Pennsylvania Turnpike, has been appointed to a similar position with the Tennessee Valley Authority. Dr. Cleaves is also profesor of geology at Washington University at St. Louis.



★ Before and after placing asphaltic mix over a gravel driveway. Typical of the "business opportunities" developed by the author

How to Start an Asphalt Driveway Business

(Without an Engineering Degree)

By W. D. Hunt

Cherokee Asphalt Paving Company
Knoxville, Tennessee

IF you want to be a millionaire, don't enter the driveway business. My partner and I started out a year ago on $5,250 (his, naturally) and are still putting down pavement. We grossed $99,000 the first year.

For equipment, we purchased all used stuff at first. A Huber maintainer, CH&E 3-5 ton roller, two dump trucks, a panel truck for the tools and men. Also a whole batch of small tools including a hand roller, smoothing iron, tamp, torch, rakes, shovels, picks, twine, wheelbarrow, axe, and wooden lutes, and a blue million other nondescript odds and ends.

Just a little shack with telephone-answering service served as our home base. Oh, we had the usual chair, typewriter (no, I think that came later as we grew filthy rich), file cabinet, from the army surplus a desk tied together with rope, and stacks of letterheads, envelopes, and statements.

For advertising purposes, we splurged on radio, newspaper, calling cards, everybody's club books and the grapevine which you can rest assured is the best. Large dispensable paper signs displayed in front of our driveways showed we weren't ashamed of it, as one fellow said.

The qualities of success, to mention a few, seem to us to be (1) honesty with all, (2) sincerity, (3) quality of workmanship, (4) reasonable prices, (5) cash collections on completion of your work. If you follow the Golden Rule, pretty soon the word gets around. This rule must be applied to your own workmen, too, because after all they're making it for you. So treat 'em right.

The work must be planned, and the plan must be worked.

Then, too, there is an item called Overhead. This "little" item must be whittled to a minimum. And HARD WORK is a necessity. This hard work starts around 7 a.m. and continues to sundown, outside. After sundown, you grab the telephone and contact prospects until bedtime (theirs).

Unless you have plenty of capital, this kind of outfit must be run by one man. At least for the first year. We started out by letting a bookkeeping service handle our books. But the remainder of the business is run by this one man. This remainder consists of all correspondence, collecting, telephoning, advertising, checking equipment, ordering parts, repairs, supplies, collecting, selling, keeping time, making up payrolls. It takes in making out checks, mailing and paying the bills, mailing statements, filing, answering complaints, keeping abreast of new methods, drooling over all the pretty new modern equipment, reading highway specs, handbooks, attending meetings, circulating among contractors (whose work is desir-

★ Contractor Hunt (white shirt) with three of his men going over a driveway sketch

able), joining the Association, working with the crew, keeping the crews busy, the customer happy.

Also keeping records of all accounts payable, and accounts receivable. All bills hosuld be kept paid up by the tenth of the month, following. Collections are as vital as good weather. We do a lot of work handled through the FHA plan. This is a very desirable financing plan for many customers, especially those without the ready cash, but with good credit ratings.

Coordination of work, crews, and equipment is very, very valuable. A minimum of time lost and maximum of jobs performed is desirable.

For future business and good recommendations, a congenial and happy customer-company relationship is essential. Keep 'em happy, but not hysterical.

I use my car continually. Carry all the books with me. One fellow asked me where my office was. I told him there were three. One (the main one) in my car, the other where the telephone is, and the third one in my home.

When a prospective customer calls us, we check all angles and problems to be overcome. Mainly the drainage and fall. By keeping in mind to save the customer money, we advise accordingly as to where the drive is to go, and just what we intend to do. The estimate consists of measuring the "job" in square yards, computing the amount of stone needed, if any. Our prices vary as to the job. The driveway when finished is only as good as the base and sub-base, so we plan a good substantial base at the minimum cost. (Many people want something for nothing). Drainage is vital, so plan proper drainage.

Everyone, though, will not be pleased, and I'll show you several gray hairs signifying the worry over the displeased customers I've had.

★ This contractor believes in prominent advertising signs posted on his work. Black top being placed over rough gravel drive

Our Usual Procedure

First, we grade the driveway with our grader, level low and high spots, dress up for proper drainage, spread stone, rake and again level. Then we roll the stone, remove soft spots and spread hot mix either by hand rakes or by spreader box. The edges are bumped smooth and straight, and then the job is rolled to finish. Any cracks or breaks are ironed smooth and together with the smoothing iron. The area is cleaned up for a neat job.

Everyone is a key man in our little outfit, and all must be dependable. A slacker or shiftless drunkard is not tolerated. Each man must be a jack of all trades. Many times even the customer can be used to drive a truck, roll or use a shovel.

If you need an assistant, pick one as good as you are, and one who is capable, tireless, willing, exacting, and willing to work like the company is his own.

The weather must be taken into consideration. Rain and snow are a hindrance to this business. Sunshine is a delight. Freezing weather is a time to do your knitting. I would recommend anyone who has not the patience or fortitude to uphold his end to look for another type of business. You can't eat your meals on schedule. Anyone wishing regular hours, and comfy position, should not be happy in the driveway business.

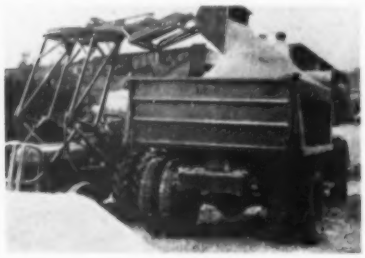
We will probably hit the $200,000 mark this year. All of our equipment has been replaced, so that now we have a new Huber maintainer, with the dozer attachment, another roller, three new Ford dump trucks, two trailers, a spreader box, a new Ford pickup, and a mighty fine reputation to back us up. We just completed thirteen driveways, and a new road for the Parade of Homes, built by the local Association of Home Builders, which was exclusive. More and more people are turning to "Capco Driveways." We have had our share of hard times, but so far we haven't had to borrow a nickel.

★ (Left): Laying hot mix—done with a spreader attached to back of truck. (Right): New equipment purchased by Cherokee Asphalt Paving Co. to replace the used equipment it started with

WHAT'S NEW
in EQUIPMENT and MATERIALS

Loader Has 180° Swing

A new swing loader with 180 degree lateral swing for loading and dumping, without awkward tractor maneuvering, is now being marketed by Wagner Iron Works, 1905 South First St., Milwaukee, Wis. Designated the model WSL, this new Wagner swing loader has been under development for five years. Its boom is capable of executing a 90 degree swing to the right or left for loading or dumping on either side of the tractor. Equipped with third cylinder action, the WSL utilizes Wagner's standard independent hydraulic system and can be equipped with all Wagner standard attachments. Capable of lifting half a ton, the WSL can lift and crown loads to a height of 10 ft.



Model WSL Swing Loader

On bound-in post card please fill in description of item on which more information is desired. The card is provided for your convenience in making inquiry and in obtaining catalogs or other data. Card works for both advertising pages and reader items.

Drop post card into outgoing mail. No stamp is required.

Hydraulic Spreader for Ice Control

The new improved hydraulic Spreadmobile, announced by Baughman Manufacturing Co., Jerseyville, Ill., introduces several important features designed for greater convenience and more efficient operation in spreading various materials for ice control. Important among these improvements is the all-new complete hydraulic operation. By means of convenient controls in the truck cab, the driver can easily and accurately control both the width and the amount of the spread of the skid-proofing material. Two independently operated hydraulic motors perform these functions; one motor drives the drag chain which pulls the material from the back to the front of the body (the speed determines the amount of material to be distributed.) The same motor also drives the cross-feed conveyor which carries the material from drag chain to distributor. The second hydraulic motor drives the distributor itself. (Its speed determines the width of the spread—with a range of 1½ ft. to 40 ft. The exclusive Baughman "Center-Spred" design is another important Spreadmobile feature. This improved spread pattern is achieved by locating the distributor between the front and rear wheels, on the driver's side. As

New Baughman Spreadmobile

This Year More People, More Goods Than Ever Before Will Travel over Highways Built with

CUMMER ASPHALT PLANTS

Cummer Offers You the Immense Advantage of More Than Half a Century's Experience in Superior Asphalt Plant Construction

The building of new highways, roads and streets and the improvement of existing thoroughfares are everywhere being pushed forward with the help of Cummer Asphalt Plants. Contractors know that they can depend on Cummer Plants—whether portable, semi-portable or stationary—for fast, profitable production.

The busy Cummer Asphalt Plant pictured at the right is the property of Mooney Bros. Supply Co., New Castle, Penna. This portable model is a complete plant with a capacity of 55 to 60 tons per hour (based on 5% initial water content, dried to within ½ of 1% and heated to 350°-400°F.) and is equipped with dust elevator, washer and enclosed hot and cold elevators.

Designed for efficiency and of exceptionally rugged construction, Cummer Asphalt Plants, manufactured continuously since 1895, have always proved to be consistent money-makers for the contractors who operate them.

Cummer Asphalt Plants Lead the Field with These Outstanding Features—

Mixing towers with vibrating screens and mixer.
Dust collector discharging reclaimed dust into hot elevator.
Two furnace combustion with low pressure burner equipment.
Cold storage bin and feeder.
Enclosed hot and cold elevators.
Diesel or electric power.

CUMMER PLANTS—complete with all motor and starter switches—are available in sizes from 55 to 125 tons per hour. Write for illustrated Cummer Catalog today.

THE F. D. CUMMER & SON COMPANY

1827 East 18th Street — Pioneer Builders of Fine Asphalt Plants — **Cleveland 14, Ohio**

a result the material is spread in front of both the front and the rear wheels. In addition to providing better traction for the Spreadmobile itself, the pattern permits the driver complete visibility and control at all times.

For Small Jobs and Overlap Rolling

For small and supplementary rolling jobs with percentage profits proportionate to major work, the Gabb Special Products Division of E. Horton & Son Co., Windsor Locks, Conn., offers the ½-ton tandem "Motoroller" Model AR. The machine is designed for accurate and effective rolling, economy of operation, and easy job-to-job

"Motoroller" Model AR

transportation. Operation within areas inaccessible to larger units, and the rolling out of laps in conjunction with heavier equipment are noted as special functions. Three Motoroller models are available—the Tandem (here pictured) the Caster and the Standard.

Hydra-Wedge for Felling Trees

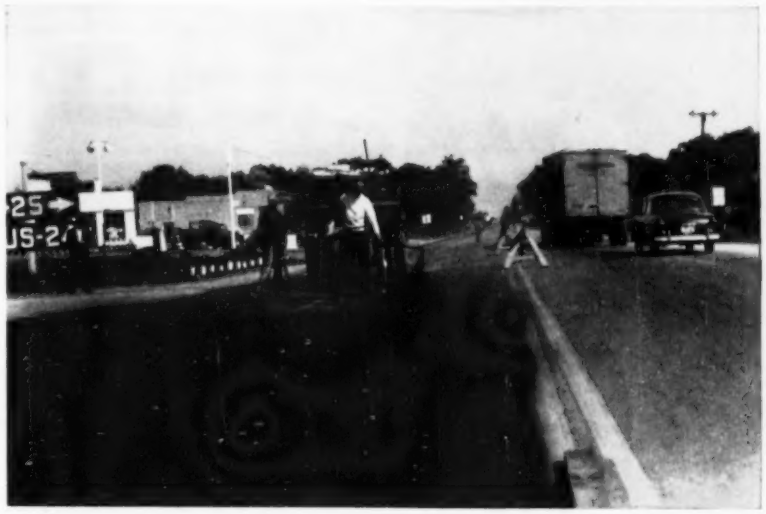
A new hydraulic wedge for felling trees has been announced by Hufford Machine Works, Inc., El Segundo, Calif. Weighing approximately 20 lb. and measuring 24 in. long, it is designed to replace the usual sledge hammer and numerous steel and wood wedges heretofore required. The Hydra-Wedge is a completely integral unit consisting of a manually operated hydraulic pump, a power cylinder and a tapered wedge attached to the end of the piston rod. The wedge is sheathed on each side

The Hydra-Wedge

by two thin blades hinged to the main cylinder casting. In use, these blades are inserted in the saw kerf of the trunk. Pumping the handle then forces the wedge between the blades and is stated to effect lifting forces up to 90,000 lb., sufficient for tipping even the largest trees with less effort. Design of the tool overcomes any

JENNITE J-16®

Surface Seal



IN SEPTEMBER 1949, the intersection of Highways U.S. 24 and U.S. 25 outside Detroit, Michigan, was sealed with J-16 for Michigan State Highway Department to stop asphalt pavement distortion through elimination of softening action of fuel and oil drippage from excessive vehicle stopping and starting.

IN OCTOBER 1952, Officials reported that the J-16 seal continues to serve its purpose after three years of traffic amounting to 3,000 to 3,500 trucks and automobiles per day.

Protective maintenance pays

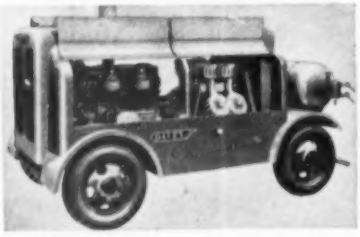
For complete details on Jennite J-16—Write for Specifications and these two brochures.

MAINTENANCE INC.
WOOSTER · OHIO
CABLE ADDRESS "MINCO"

tendency to eject the wedge from the kerf. No straps or other holding devices are required around the tree trunk. If insufficient lift is obtained for tippling slanted trees at one setting, the tree may be wedged, the Hydra-Wedge backed out by reversing the pump and re-inserted deeper into the kerf.

600 c.f.m. Portable Diesel Compressor

A new 600 c.f.m. diesel-powered portable compressor has been announced by the Davey Compressor Co., Kent, O. Known as the "Davey Super Chief 600," the new unit is available in both skid and 4-wheel trailer mounting styles. The new compressor has 4 low pressure cylinders with 8-in. bore and 4-in. stroke, and 2 high pressure cylinders with 6⅝ in. bore and 4-in. stroke. Standard features include automatic compressor-engine controls; individually - finned, separately - replaceable cylinders; full force feed lubrication; cast aluminum crankcases; multi-port valves; automotive type steering; full spring suspension; built-in, full length tool boxes.



Super Chief 600 Compressor

Grease for Extreme Temperature Conditions

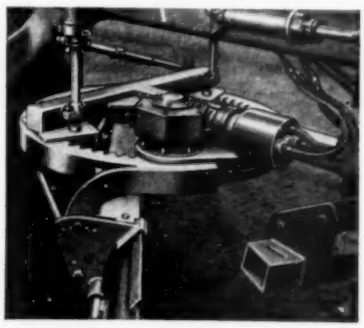
A "global" grease which performs effectively in desert or arctic operations has been developed by the research laboratories of The Texas Co., 135 East 42nd St., New York, N. Y., for use in military vehicles. Known as Texaco All Temp Grease, the new lubricant contributes to the solution of a difficult logistics problem. This problem can best be demonstrated by citing the case of a vehicle which might have to be flown from a desert military post to an installation where sub-zero temperatures are normal. In times past it has been necessary to completely relubricate the vehicle. This meant ordering, storing, transporting, and applying a large variety of greases. Texaco All Temp helps to eliminate this logistics problem with a lubricant which efficiently lubricates vehicle bearings in ambient temperatures ranging from minus 65 degrees (F) to plus 125 degrees (F). This new grease possesses the following characteristics: good low temperature operation, excellent shear stability which prevents leakage in tropic heat, high oxidation resistance which imparts long life, good rust and corrosion protection for metal parts, and the capacity to perform even when contaminated with water.

Safety Flag for Trucks

A safety flag for ready-mix and road materials hauling trucks has been introduced by The Wright Flag Co., Nappanee, Ind. It clamps on top of door of truck cab. A sturdy, enclosed spring, which is weather-resistant, holds flag staff rigid, with window open or closed. No adjustment required. Banner is bright red, tough, gabardine and is 10 in. x 6 in. Banners resist rain and sun.

Galion Grader Has Hydraulically-Operated Circle

The Model 503 tandem drive motor grader of The Galion Iron Works & Mfg. Co., Galion, O., is now available with a hydraulic-powered circle. The circle is actuated by a powerful heavy-duty hydraulic motor. Connection from the motor to circle is by means of an enclosed worm reduction gear, and a spur pinion gear which meshes with the teeth on the circle. It is claimed that the location of the gear teeth on the inside of the circle permits a more compact and rigid assembly, as well as providing greater protection to the gear teeth from accidental damage. Control of the circle rotation is by a simple movement of a lever on the operator's platform. The circle has a turning range of 140°. It may be stopped at any desired position, the hydraulic system providing an autoomatic lock.



Circle Turning Mechanism

KLING XX CONCENTRATE FOR BITUMINOUS PATCHING

THE FALL PATCHING SEASON APPROACHES. BE PREPARED TO MAKE HIGH TYPE PATCH MATERIAL BY USING KLING XX CONCENTRATE, THE MOST EFFICIENT AND LEAST COSTLY ADDITIVE FOR BITUMINOUS MATERIALS. AT LOWEST COST PER TON OF MIX.

★ ★ ★ ★ ★ ★

TO YOU PRODUCERS OF PLANT-MIX STOCKPILING MATERIALS:

KLING XX CONCENTRATE (1) gives you a complete coating; (2) allows stockpiling without stripping; (3) increases workability permitting loading at below freezing temperatures; (4) allows stockpiles made in the Fall to be available in the Spring before your plant opens up—and, most important, lets you produce a patching material which stays put—even in wet potholes.

You may stockpile yourself or let your State, County, City or railroad customers do it in their own yards.

TO YOU ENGINEERS AND FOREMEN MAKING YOUR OWN PATCHING MATERIALS:

KLING XX CONCENTRATE (1) permits coating of cold, wet aggregates when using liquid bituminous materials; (2) allows no stripping; (3) makes penetration-type patching possible in wet weather and—as with the plant-mix type—the patch material really bonds to a wet base.

KLING XX GOES TWICE AS FAR! ! REMEMBER, IT IS A DOUBLE STRENGTH ADDITIVE FOR ASPHALT OR TAR AND YOUR COSTS ARE ONLY A FEW CENTS A TON.

WRITE US TODAY. WE HAVE THE ANSWER TO YOUR PATCHING DIFFICULTIES.

LANCASTER CHEMICAL CORPORATION

9 ROCKEFELLER PLAZA **NEW YORK 20, N. Y.**

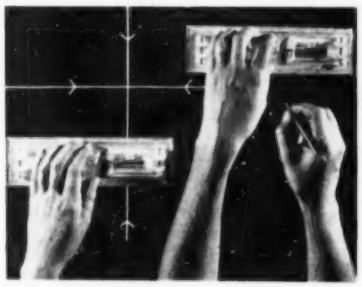
New Heavy-Duty Engine

Production is now in full swing at Kohler Co., Kohler, Wis., on a new heavy-duty engine, the K-660. A four-cycle, air-cooled, two cylinder opposed power plant, it delivers up to 26.8 h.p. while running at 3600 r.p.m. Designed for heavy-duty operation, the new engine weighs 225 lb. Its overall dimensions are: length—18-13/16 in., width—23⅛ in. and height—27-9/16. Standard equipment on the new K-660 includes a heavy-duty silencer-type muffler, automotive diaphragm type fuel pump, oil bath air cleaner and an oil pressure gauge.

Model K-660 Kohler Engine

Portable-Pocket Drafting Machine

A versatile new tool for drafting, the Glide-Rule, announced by Smith Drake Corporation, 1206 South LaBrea Ave., Inglewood, Calif., is a transparent drawing instrument, capable of rolling in two directions and combines important engineer's tools in one—triangles, T-squares, straight edge, scales, protractor and parallel rules—is in effect, a "pocket-portable" drafting machine. For precision drawing in the field, the Glide-Rule, is easily carried in the pocket (size 2½ in. x 9 in.) eliminating bulky drafting boards, T-squares, etc. The instrument has the advantage of extremely accurate, engraved scales and protractor; four drawing edges with scales in 16ths and 20ths; the protractor is a full 180°, with emphasized 30°, 45° and 60° angles.



Glide-Rule in Action

Gang Mowers

New units of the Worthington Mower Co., Worthington, Pa., were shown for the first time at the recent American Institute of Park Executives Conference at Denver, Colo. Among these new units was the Worthington Three-Gang Rotary Blitzer which is stated to cut a 17 ft. 2 in. swath through even the toughest growths. The new mowers are independently powered by heavy-duty, 13.3 hp Wisconsin air-cooled engines which are specially designed to

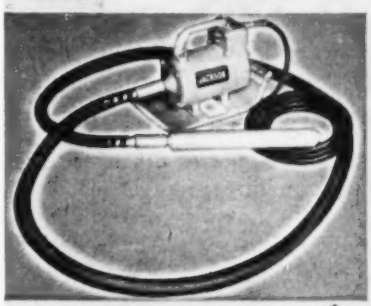
6 WAYS TO STEP UP RESULTS *and* PROFITS!

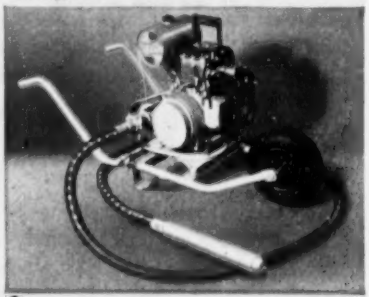
MACADAM CONSTRUCTION

In one pass the Jackson Multiple Compactor will compact 12" of rock to support smooth rollers. In 4 passes compaction to final density may be obtained. With 2 passes all voids from top to bottom can be filled with fines. In gravel sub-bases 7" thick, one pass suffices to produce densities exceeding 100% Standard Proctor. Working speeds from 0 to 60 ft. per minute. 5½ MPH travel speed.

SOIL COMPACTION. The powerful, new, self-propelling Jackson Compactor, with 12" to 26" interchangeable bases, achieves specified density of granular soils in 8" to 10" depths at 2400 sq. ft. per hour. Perfect for bridge and pipeline fills, concrete floor sub-bases, etc.

BLACKTOP WIDENING & PATCHING. The same machine, operated from power plant on auto-trailer with pickup for Compactor, is most efficient means of blacktop pavement widening and patching, paving walks, drives, etc. Compacts 2400 sq. ft. per hour, close to maximum density.





GENERAL CONSTRUCTION. (left); 6 H.P. engine driven, flexible shaft vibrator. Excellent for both thin and thick sections. (Right); 2½ H.P. electric vibrator for light socket operation. Handy as a pocket in a shirt, powerful enough to handle all general construction concrete vibration with shafts up to 28'.

DUAL CURRENT PORTABLE POWER for operating all Jackson machines and lights. 1.5 to 7.5 KVA, providing both single and 3-phase 60 Cy., 120 V, AC (120/240 V in larger models). Permanent magnet generators require no adjustment or maintenance.

FOR SALE OR RENT AT YOUR JACKSON DISTRIBUTOR

JACKSON VIBRATORS, INC.

ELECTRIC TAMPER & EQUIPMENT CO.

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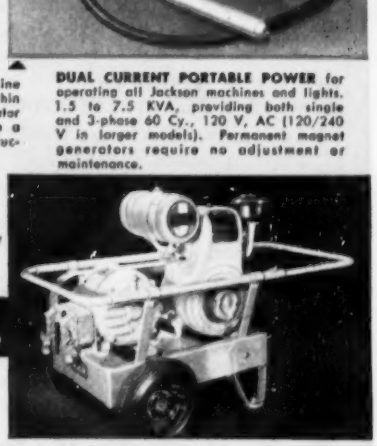


give extra cutting power at all speeds, regardless of growth density. The unit is adaptable for use with any prime mover, as well as the Worthington Model G. tractors. Also demonstrated was the new 42 in. rotary mowing attachment for Massey-Harris Pony and International-Harvester Cub tractors. Other Worthington P.T.O. Rotaries in the 72 in. size were also shown which, with the Worthington 90 in. unit, now completes the P.T.O. line of Worthington rotaries. All three of the Worthington P.T.O. Rotaries, the 42 in., the 72 in., and the 90 in., are available with a leaf mulching accessory. A new Worthington three-gang triple, for use with both Massey - Harris and International - Harvester tractors, was another new product shown. The three-gang units utilize a built-in tractor hydraulic system to lift the mowers for between-job-travel.

New Mild Steel Electrode Announced

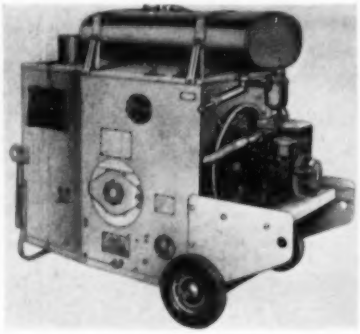
A new, improved E6010 electrode, the Airco 78E, for welding mild steel in all positions, has been announced by Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y. This new electrode is claimed to offer deep penetration without undercutting, a minimum of spatter, and uniform weld deposits without fingernailing. The deposit solidifies quickly which especially adapts this electrode for welding in the vertical and overhead positions.

Conveyor Belt Sheds, Retains Water

A rubber conveyor belt made with a surface that sheds or retains water is now helping in the production of taconite, a valuable new source of iron ore. The belt automatically dewaters finely ground taconite as it conveys the wet material from storage tanks for processing. A simple adjustment makes the belt retain water with equal ease. Called "Riffle Grip," the belt is made by The B. F. Goodrich Company Industrial Products Division, Akron 18, O. The secret of the belt's dual performance lies in its unique cover design. Molded rubber ridges which stand ⅛ in. high are formed in a continuous series of chevron patterns spaced several inches apart.

Portable Heater

A redesigned standard model Herman Nelson portable air heater, announced by American Air Filter Co., Inc., 1824 Third Ave., Moline, Ill., is powered with a new



Herman Nelson Portable Air Heater

Briggs and Stratton Model 6 engine. A new addition is a fuel metering valve which can reduce the capacity of the unit from its maximum 385,000 BTU's to a low of 100,000 BTU's per hour. This permits considerable saving in fuel consumption at the lower, frequently desired capacities.

EDITOR WANTED

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An important and interesting position is open in the editorial department of Roads and Streets.

If you are a civil engineering graduate, with a few years of engineering and construction experience, and if you feel you have a flair for writing and would like this kind of work, write us giving us your experience, qualifications, personal data, and salary requirements. Letter held confidential.

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Roads and Streets
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Signature

Twin-Compactor Units for Pavement Repair

Jackson Vibrators, Inc., Ludington, Mich., report that the twin-compactor units which they recently announced are meeting with considerable favor on the part of those engaged in pavement repair and replacement. The machine is comprised of two standard Jackson vibratory compactors, with 26 in. bases. Since they are self-propelling, one man, it is said, has no difficulty in operating the twin-unit. In the accompanying illustration the machine is shown in operation on Route 1, near New Brunswick, N. J., compacting sub-base in a removed section of pavement prior to renewal of the pavement. An auto-trailer providing quick pick-up of the twin-unit compactor, on which is mounted the power plant supplying current for the compactor, makes the entire outfit easy to move from place to place. Each of the units comprising the twin-compactor is said to deliver up to 4500 1¾ blows per minute and units may be used separately where restricted areas so dictate.

Twin-Compactor Unit on Job Near New Brunswick, N. J.

New Air Hose Offers Unusual Flexibility

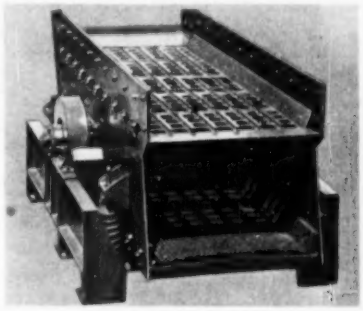
A new high pressure air hose for tunneling, construction work and mining, announced by Boston Woven Hose & Rubber Co., P. O. Box 1071, Boston 3, Mass., is claimed to combine unusual strength and ruggedness with extreme flexibility. The steel wire used in the horizontal braided construction enables the hose to carry working pressures as high as 2,000 lb. per square inch. The new hose, called Concord Yellow Jack, is designed with a specially compounded yellow cover for ready visibility in underground work, thus avoiding accidental damage to the hose and costly production delays. Concord Yellow Jack is being manufactured in eight different sizes, ranging from ⅜ in. to 2½ in. inside diameter.

New Drive Shaft Bearing for Marion Hoists

A new drive shaft bearing, announced by Marion Metal Products Co., Marion, O., is designed to give longer bearing life. This new easier-to-install bearing is an engineering improvement furnished with all Marion hoists at no increase in cost. The new unit is sealed to keep out road dirt and to retain the lubricant. Built around an anti-friction roller bearing, the new DSB has a heavy malleable iron casting body with a steel adjusting bolt and lubricator.

"Mesabi" Type Screens Redesigned

Redesigned to give heavier service, more efficient operation and greater durability, the "Mesabi" type vibrating screens built by Pioneer Engineering Works, Inc., Minneapolis 13, Minn., Division of Poor & Co., Chicago, are now available in single deck (for scalping) and 2-deck (for scalping or sizing) in the following sizes: 4 ft. wide—10 ft. and 12 ft. long; 5 ft. wide—10 ft. 12 ft. and 14 ft. long; 6 ft. wide—12 ft. and 14 ft. long. In the 2-deck scalping screen, the top deck is ½ in. punched plate and the bottom deck is wire mesh. The single-deck scalping screen has a ¾ in. punched plate deck. In the 2-deck sizing screen, both decks are wire mesh. The main frame on all the 4 ft. screens has been redesigned to include an 18 in. car channel reinforced with 8 in. cross beams while the 5 ft. and 6 ft. wide screens have been redesigned to include 18 in. I-beams reinforced with 8-in. cross beams.



New Pioneer 4 ft. x 10 ft. Mesabi Scalping Screen

LB LITTLEFORD "Spray-Master"

BLACK TOP ROAD MAINTENANCE EQUIPMENT SINCE • 1900

BITUMINOUS DISTRIBUTOR

Gives Low Cost • Mix in Place • Seal Coat Jobs

Here's the Bituminous Spraying unit that will handle Asphalt, Tar, Emulsions, Cut-Back and Road Oils for any road maintenance or construction work. It's engineered to operate with the minimum of cost and designed to eliminate valves, pipe lines and controls, making it simple to operate.

Spray Bars operate up to 24 ft. in width, both the Standard Suck-Back Bar or the Full Circulating Vacuum Flow Bar give 100% efficient spraying action.

Littleford "Spray-Master" Bituminous Distributors are the most modern units on the market today. Made in either truck mounted or semi-trailer models. Sizes range from 800 to 4000 gallons.

"Spray-Master" Distributors are fast heating, safe, efficient, low-cost in operation. See your nearest Littleford Dealer or write.

LITTLEFORD BROS., INC., 454 EAST PEARL STREET, CINCINNATI 2, OHIO

ROSCO'S P.M.*

makes the difference

Applying bitumen through 2 feet of spraybar as shown may not appear unusual or different, but when the operator can use any length—from 1 to 24 feet—*without changing the pressure* and *without any application adjustment whatever* . . . then there's a difference. It's *Rosco's Pressure Metering Method* that makes that difference.

The P. M. method of applying bitumen is *not* metered by the bituminous pump, nor is the amount of discharge measured in relation to the pump revolutions. Normal wear of the pump and occasional, unavoidable nozzle clogging never affect the application rate. Here again, Pressure Metering *makes the difference* . . . the rate is automatically maintained by Rosco's P. M. system.

It is this Pressure Metering Master Valve, the "heart" of Rosco Distributors, that gives you this built-in control of pressure which is the only accurate method of obtaining precise bituminous application. This is the valve that also directs the flow of material for all of the Rosco Distributor functions.

Make the difference pay off. Let your Rosco dealer show you how. Write the factory for descriptive bulletins with specifications of Distributors with P. M.

***P. M. =**
Pressure Metering

•

ROSCO MANUFACTURING CO.
3118 Snelling Ave. • Minneapolis 6, Minn.

Unit Machine Has "Gooseneck" Trenchoe Boom

A new all-welded trenchoe boom with the "Gooseneck" or offset design is now the standard trenchoe attachment for Model 1020 ¾ yd. machine of Unit Crane

Unit Model 1020 with Gooseneck Trenchoe Boom

& Shovel Corp., 6411 West Burnham St., Milwaukee 14, Wis. This new design trenchoe boom provides added strength and greater digging depth.

Heavy-Duty Motor Oil

A new highly detergent heavy-duty motor oil—Advanced Custom-Made Havoline—now being marketed nationally by The Texas Co., was formulated especially to meet the severe lubrication demands of the newest high-power automobile engines. The new product was developed as a result of years of continuous studies of chemical additives carried out at the Beacon (N. Y.) Laboratories, Texaco's main research center. A leader in additive chemistry, The Texas Co. has incorporated in Advanced Custom-Made Havoline unusual detergent properties which promote the efficient operation of such precision mechanisms as the hydraulic valve lifters now common in the newer engines. Extensive road tests covering a wide variety of driving conditions—low temperature, low speed, and high load, stop-and-go, high speed and high temperature, and so on are stated to have confirmed laboratory findings that the cleaner engine operation results in reduced engine wear and longer operating life.

New Extension Booms for Gradall

Two boom-extension attachments designed to further broaden the applications scope and operational versatility of the Gradall have been announced by Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O. The first attachment is a 12-ft. extension which, affixed to the regular telescoping, 24-ft. boom of the unit, extends its working reach to 36-ft. Used only with an 8-ft. blade, this extension is stated to be particularly suitable for grading and sloping operations. The second

Gradall with 12-ft. Extension Boom

boom extension is a 4-ft. unit, which is intended to be particularly suitable for grading and sloping operations. The second boom extension is a 4-ft. unit, which is intended for use with digging buckets up to 24-in. With it the digging depth of a Gradall is increased from 10-ft. to approximately 14-ft. Normal dumping height of 14-ft., 9-in., is increased to over 17-ft., and the reach of the unit lengthened from 24-ft. to 28-ft. Both extensions are quickly and easily mounted to the regular Gradall boom.

HOPKINS VOLCANIC UNITS Help Set "Fireball" Pace on New Jersey Turnpike Project

The 118-mile New Jersey Turnpike is the biggest paving project of its type in the world, and the longest asphaltic-concrete job ever undertaken on so short a schedule. With only 5 months actual working time, and tough spex to meet, a terrific production schedule had to be maintained. So, to supply concrete for Sections 3 and 4, four huge asphalt plants were erected at Cranbury. Sitting side by side, each plant turned out 2-ton loads every minute. That's 8 tons a minute, or almost 500 tons per hour . . . a really "fireball" pace!

The four asphalt plants were all equipped with Hopkins Volcanic Dryer Units, and Mr. John McGarry, Vice President of the Tioga Construction Company, later wrote us as follows: "We were producing 25,000 tons of asphalt paving material a week. We found the Hopkins equipment does its assignment efficiently and with a minimum of maintenance."

Contractors throughout the country are setting new production records, and cutting costs, with Hopkins Volcanic Units. Want to know more? Your letter or phone call will bring descriptive literature, complete details, and follow-up by a Hopkins representative.

HOPKINS VOLCANIC SPECIALTIES, INC.
ALLIANCE, OHIO

New Type Reversible Ripper

A new reversible ripper (patent applied for), announced by Kritzer Equipment Co., Inc., 3843 West Slauson Ave., Los Angeles 14, Calif., mounts directly on the tractor and is adjustable for digging depth between 8 in. and 16 in. It is set to operate automatically while the tractor is either in forward or reverse motion. For instance the units in the illustration are set to operate when the tractor is backing up. When the tractor goes forward, the ripper tooth simply drags over the ground. For operating while the tractor is going forward, the tooth is turned around so that

Kritzer Ripper on Tractor

it is pointing forward. A standard ripper tooth is used and may be installed for either side or draw bar mounting. It rips straight, being guided by the course of the tractor itself, is easily portable, and may be used on any make tractor.

Motorola Extends Accessory Line

The Communications and Electronics Division of Motorola, Inc., 4545 W. Augusta Blvd., Chicago, Ill., has recently augmented its line of two-way radio base station accessories by adding three new microphone models. All three employ identical cartridges, smaller and more sensitive than those used in previous models. They are uni-directional dynamic microphones having a spring-suspended moving coil unit to prevent shock noises. Two of the models, the TU151 and TU152, are mounted on a desk stand and the third, the TU140, on a movable floating arm. The two desk stand models are identical except for the microphone connectors. The "push-to-talk" button is installed in the desk stand base.

Rotary Snow Plow for Jeep

A new plow attachment for its Jeep, stated to throw snow 40 to 70 ft. off of highways, has been announced by Willys Motors, Inc., Toledo 1, O. The new plow is of the rotary type, and tests conducted by Brede Products, Inc. of Minneapolis, maker of the new attachment, are stated to show that it can operate effectively in deep snow at speeds up to 20 miles an hour. The plow is removable from the Jeep and has its own auxiliary (72-h.p.) Jeep engine in the rear, although its operation is controlled from the driver's seat. There is also a special "converter" which enables the plow to pile the snow up at the curb in urban streets.

Pneumatic Rollers Have Wide Face Tires

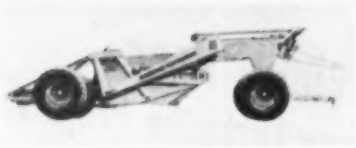
The improved pneumatic tire rollers of The Wm. Bros Boiler & Mfg. Co., Minneapolis 14, Minn., now have new, wide face tires at no extra cost. These tires are stated to permit full compaction coverage on every pass, eliminating any shifting of voids and low spots, and the building of ridges and lines. The improved king pin design featured on Bros pneumatic tire rollers permits towing tongues to float freely, bolsters now being mounted on conventional type of fifth wheel. Drawbar hook-ups can be made quickly at any height.

Light Weight, Low Cost Hoist

A new twin cylinder Model 2426 hoist, announced by The Heil Co., Milwaukee 1, Wis., is specifically designed for 8 ft. to 17 ft. long platform bodies and 8 ft. to 10 ft. dump bodies. Operating features claimed for the new hoist include a 50° dumping

Model 2426 Heil Hoist

angle for swift and positive dumping of all materials—even wet, sticky dirt; a low first cost because of simple construction; and a new low in mounting height, with the space from top of the truck chassis to bottom of the body only 9-15/16 in., for an easy hand loading height.



New Open-Top Scraper

New Line Open-Top Tractor-Drawn Scraper

A new line of open-top, tractor-drawn, rubber-tired scrapers ranging in capacity from 10.5 to 28.5 cu. yd., announced by LeTourneau-Westinghouse Co., Peoria, Ill., is designed to fit any tractor-scraper job and is available in four sizes. The O-14 carryall scrapers, which is designed for use with tractors of 70 h.p. or more, has a struck capacity of 8.1 cu. yd. and a heaped capacity of 10.5 cu. yd. O-19 carryall scraper for use with 75 or more h.p. tractors has a struck capacity of 12.2 yd. and heaped capacity of 16 yd. The third size of the open-top line, O-23 for use with 80 or more h.p. tractors, carries a struck capacity of 14.4 yd. and a heaped capacity of 19 yd. The Model O-35 carryall scraper carries a load rating of 22.5 yd. struck and 28.5 yd. heaped and is designed for 100 or more h.p. tractors.

Seven New Models Added to I-H Power Unit Line

Seven new 6-cylinder models have been added to the gas-gasoline power unit line of International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. The line now includes 12 engines ranging from 16.5 to 200 net maximum horsepower. New valve-in head power units and their horsepower ratings follow: U-1091 (natural gas), 180 net hp @ 1,375 rpm or up to 200 net hp @ 1,600 rpm on factory-approved applications; U-450, 102 net hp @ 1,800 rpm; U-406, 91 net hp @ 1,800 rpm; U-372, 83 net hp @ 1,800 rpm; U-269, 62 net hp @ 1,800 rpm; U-240, 55 net hp @ 1,800 rpm; and the U-220, 50.5 net hp @ 1,800 rpm. Basically, the new U-1091 power unit and the International UD-24 diesel power unit have many common components. Principal differences are a different cylinder head and elimination of the fuel injection system. The new model is also equipped with lower compression pistons, a large updraft carburetor, magneto, spark plugs, and a gear-driven, variable-speed governor. The six other new models are power units which have International truck engines.

Protective Coating Provides Long Rim Life

Continued exposure to weather takes a heavy toll of trucks, trailers and farm implements and the rims of these vehicles, being nearest the ground, naturally are subjected to more abuse than most other components. The rims are likely to be taken pretty much for granted, however. They seldom receive special care. For this reason, a protective coating which will successfully withstand the elements is of prime importance to long rim life. Goodyear Tire & Rubber Co., Akron, O., at its rim plant has developed such a material, now being used to give added protection not only against weather, corrosion and the damaging effects of salt, but also against marring, discoloration and other adverse factors. Known as Bond-A-Coat, the new material has been proved by actual test to be far superior to commercial galvanizing—the conventional method of rim coating used over the years, the company states. Rims finished by the new method can be stored in the open without rusting or discoloring, according to Goodyear. Another advantage, it is pointed out, is the fact that the process greatly enhances the rim's appearance over that of galvanizing. Bond-A-Coat results in a bright, hard aluminum finish, described as "similar to that of zinc plating."

Redesigned Welders Incorporate Advanced Features

Redesigned 300 and 500 Amp. A. C. welders, announced by Metal and Thermit Corporation, 100 East 42nd St., New York 17, N. Y., are stated to incorporate the following advanced features. Fast range-changing made easy with a new range switch—no leads to unplug, no connections to make. Power saving—primary switch permits turning off current at the welder between welds. Case stays cool—large fan forces adequate ventilation to all parts.

Redesigned Arc Welder

Total Patching Cost
(Materials, labor, processing)
$3.75 per ton

with the H&B Moto-Patcher

● Here's an example of the way the Moto-Patcher cuts patching costs. According to Mr. Fred Tayntor, Commissioner of Public Works, Rome, N. Y., prior to May 15 their Moto-Patcher had mixed over 1500 tons of patch material (50% ¾" stone—50% ¼" stone) with RC No. 3 cutback as the bituminous material. The total cost, including materials, labor and processing, was $3.75 per ton.

This mobile mixing unit delivers up to 10 tons per hour of freshly mixed material. Automatic control of the metering of the asphalt and feeding of the aggregate insures a constantly uniform mix. The 400 gallon tank, which is an integral part of the unit, provides an adequate supply of bitumen—making frequent stops unnecessary. Aggregate may be either shoveled into the hopper or fed in by gravity directly from a truck by means of a small elevator (optional equipment) as shown above.

Other optional equipment includes a specially designed dryer and adjustable spreader attachment.

For further information send for Bulletin MPD-53

HETHERINGTON & BERNER INC. • ***Engineers-Manufacturers***

721 Kentucky Avenue • Indianapolis 7, Ind.

MANUFACTURERS' LITERATURE

Oils for Low Temperature Equipment Operation

Modern cranes, bulldozers, tractors and other construction equipment depend upon hydraulic power rather than mechanical linkages as a means for motivating many of their working parts. Most of this hydraulic equipment is subjected to wide ranges of operating temperatures. Construction equipment is exposed to ambient temperatures of 110° F. or higher in tropical climates, while the same type of equipment may be required to operate at ambients of minus 30° F. or below in the Far North. Under these temperature extremes the quality and type of hydraulic oil used becomes major factors in the success of hydraulic operations. An 8-page article, "Low Temperature Hydraulic Operation" in the October issue of Lubrication, a technical publication of the Texas Co., 135 East 42nd St., New York 17, N. Y., discusses the properties of petroleum-base hydraulic oils and the various elements of hydraulic circuits which affect low-temperature hydraulic operations. Copy of this issue of Lubrication can be obtained by writing the Texas Co.

New Conception of Belt Conveyors

A new catalog (76A) issued by Barber-Greene Co., 400 North Highland Ave., Aurora, Ill., presents a new conception of the economy, utility and simplicity of belt conveyors. The catalog shows the entire range of B-G standardized belt conveyors. Each standardized component and accessory is illustrated and described with line drawings showing the relationship of the unit to the entire conveyor. In addition, the range of application of each unit is tabulated for quick reference. Titled, "Barber-Greene Conveyors," this new catalog includes 60 pages of typical conveyor layouts and installation photographs. It clearly presents Barber-Greene's standardized drives, take-ups, truss, idlers and belting, with a broad selection of each. Among the accessories listed are feeders, hoppers, conveyor supports, backstops and brakes, walkways, housings, belt cleaners, spouts, hoods, gates, trippers and magnetic pulleys. A section on shuttle conveyors and stackers illustrates several economical stock piling systems.

Short-Cut for Soil-Cement Testing

A new 12-page booklet entitled, "Short-Cut Soil-Cement Testing Procedures for Sandy Soils," published by the Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill., explains procedures which will greatly reduce the amount of work previously required in testing soils for soil-cement pavement construction. Included in the new booklet are 10 charts on cement content, moisture content, and density of soil-cement. These charts are so planned that when correctly used they will reduce the laboratory technician's work by showing the amounts of materials to use for individual tests. Use of the charts does not involve new tests or additional equipment. The only laboratory tests required in following the new "short-cut" test procedures are a grain size analysis, moisture-density test, and compressive strength tests. Relatively small soil samples are needed, and except for results of the 7-day compressive strength tests, all tests can be completed in one day.

Cold-Feed Methods for Bituminous Plants

A 2-color, 16-page folder, illustrating a wide variety of cold-feed methods, adaptable to all makes of bituminous plants, regardless of type of manufacture, has been issued by Barber-Greene Co., 400 North Highland Ave., Aurora, Ill. The booklet makes sound engineering recommendations on the scope and advantages of many types of feed systems; recommendations which will be of assistance to operators of all types of mixing plant equipment. Featured is Barber-Greene's new series of wheel-mounted 4-bin feeders which provide accurate proportioning of the aggregate before drying. Many other types of feeding equipment are shown and their capacities are specified. Among these units are portable and stationary two, three and four bin hoppers; apron, belt and reciprocating feeders; belt conveyors, both portable and in permanent installations; tunnel conveyor systems and car unloading equipment.

Melter for Rubberized Joint Sealers

A bulletin (No. 1081), describing the new Hauck double jacketed melting furnace on wheels No. 48 special, has been announced by Hauck Manufacturing Co., 124-136 Tenth St., Brooklyn 15, N. Y. The furnace is recommended for melting rubberized joint sealers, such as rubber and asphalt, rubber and plastic, etc. The double boiler heating effect is stated to assure close temperature control by means of indirect heat. An oil with high flash point is used as a heat transfer medium. L-P gas is used as fuel. Furnace can be used with or without the removable agitator. It is stated that 16 gal. of compound can be brought up to heat in 30 minutes to 1 hour time, depending on type of compound being melted.

Heavy-Duty Lubricant for Shovels

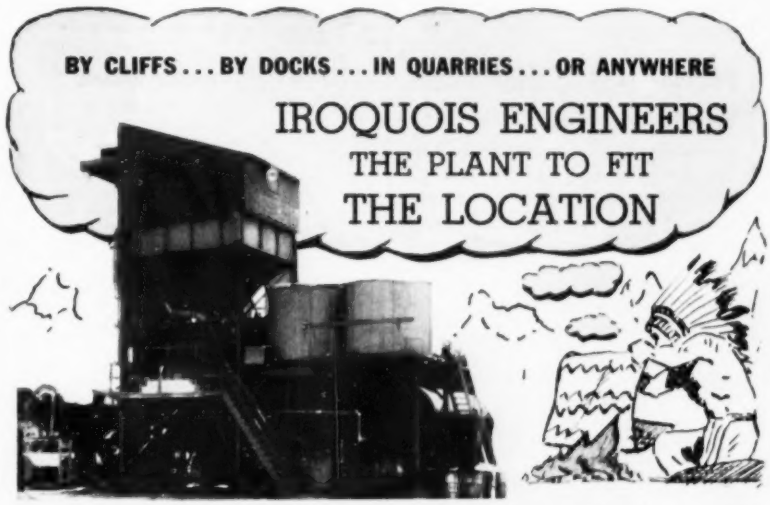
"D-A Lithium, Extra-Heavy," a new heavy-duty lubricant compounded to meet special needs where excessive heat is a problem, has been announced by the D-A Lubricant Co., Indianapolis 23, Ind. Designed around an unusually heavy base oil and an improved Lithium stearate, "D-A Lithium, Extra-Heavy" is stated to combine superior wear resistance with the ability to perform efficiently at extreme temperatures. It is recommended especially for shovels which are operating close to their upper limits, and for particularly hot-running crushing plants, shaker screens, hot mix plants, and wheel bearings where moisture and temperatures are excessive.

18 New Welding Developments

Eighteen new 1953 welding developments is announced by Eutectic Welding Alloys Coporation Dept. "P," 40-40 172nd St., Flushing 58, N. Y., in an 8-page booklet (TIS 1621). The new folder contains short, factual descriptions of the welding alloy and organic bonding developments which have emanated from its research department since the first of the year. The new developments cover welding materials used in maintenance as well as production on all metals and at various application heats.

Selector of Air Tool Capacities

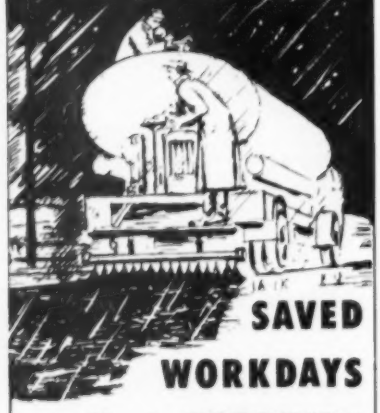
A handy gauge for determining the number of air tools that can be operated from different size compressors is available from Schramm, Inc., West Chester, Pa. The compressor sizes range from 60 cfm to 600 cfm, and the pressures are 70 lb. and 90 lb. Air tools covered by the gauge are rock drills, wagon drills, paving breakers, diggers, tampers, chain saws, circular saws and concrete vibrators.



This Iroquois one and one half ton hot mix plant is erected against a solid stone cliff . . . bounded on the other side by river docks. *All* Iroquois complete Asphalt Plants are "bullseyed" to location . . . capacity . . . type of mix. Result? The maximum production obtainable . . . at operating costs lower than that of an ordinary stock assembly. Write for free bulletin today.

*Iroquois Division**
POSEY IRON WORKS, INC.
*Established over 60 Years
LANCASTER, PA.—New York Office: Graybar Building

1. STRENGTHENS THE BOND
2. PROTECTS AGAINST WATER



SAVED
WORKDAYS
on N. J. TURNPIKE

During construction of the N. J. Turnpike, penetration courses were shot with **NOSTRIP**-treated asphalt under moisture conditions which normally would have halted the job.

NOSTRIP *offers important advantages*

in all road applications of asphalt – surface treatment, mixed-in-place (mulch), penetration macadam, etc.

How NOSTRIP can work for you

is explained in a comprehensive new brochure covering the use of NOSTRIP in all types of bituminous paving. *Send for your FREE copy today.*

NOSTRIP

MAGUIRE INDUSTRIES
INCORPORATED
182-27 Liberty Ave., Jamaica 33, N. Y.
DISTRIBUTORS EVERYWHERE

Belt Conveyors and Car Unloaders

Two models of Atlas belt conveyors and two models of car unloaders are illustrated and described in a circular issued by Atlas Conveyor Co., Clintonville, Wis. The Model 24 stationary conveyor, 224 ft. long with 24 in. belt, is pictured delivering aggregate to an overhead bin in a concrete plant. This model with 18 in., 24 in., and 30 in. belts is made up of standard pre-assembled frame units ready for quick and easy assembly into a complete stationary installation. The Model 125 portable conveyor, 60 ft. long, with 24 in. belt is shown stockpiling gravel. The Model 124 portable heavy duty car unloader, also pictured in operation, was designed especially for handling heavy abrasive materials such as sand, gravel and crushed rock. It is stated to have a capacity up to 190 tons per hour. All the Atlas models were designed for high capacity, smooth, quick operation, long service life, and low maintenance costs.

"Inside" of Lorain Shovels

A new book on the construction of their Lorain-TL series of shovels and cranes, entitled "The Inside Story on the Package Component Design of the Thew Lorain TL Series," has been published by The Thew Shovel Co., Lorain, O. One of the features of the Lorain TL Series of power shovels and cranes is the "packaged assembly" of the turntable. All major assemblies such as hoist shaft, clutch shaft, engine, etc., are completely packaged components, built as integral sub-assemblies for ease of assembly, disassembly and servicing. To show this important feature graphically was the shovel company's problem. It was solved by using an 8-page "Trans-Vision" book which consists of rotogravure printing on transparent acetate film so that the various assemblies in the machine can be superimposed on each other just as they are in the actual machine. Each page displays one "packaged" component of the turntable in complete detail. Collectively, the pages illustrate the entire turntable.

Heavy Duty Tractor Winch

A 4-page catalog (125-H-3A) on its Tractowinch has been issued by American Hoist and Derrick Co., St. Paul 1, Minn. Illustrations show many applications of this winch. Specifications are included. The Tractowinch, which was developed especially for heavy duty work, is a single drum unit with a maximum capacity of 7,500 lb. single line pull on the first layer of cable. The Tractowinch is adaptable to many industrial wheel-type tractors, and can be easily installed for winch work or quickly removed when the P.T.O. shaft is required for other attachments.

Emergency Electric Plants

A new 4-page booklet, issued by Homelite Corporation, 865 Riverdale Ave., Port Chester, N. Y., describes and pictures Homelite carryable generators designed to supply emergency electric power. The booklet explains the various functions and uses of these compact, lightweight, gasoline-engine-driven generators. The booklet (L-411) also includes a section on specifications, electric output, and prices of five of Homelite's most popular models.

Sewer Compound Melting Pots

A new illustrated brochure No. 232A, issued by Aeroil Products Co., Inc., 69 Wesley St., South Hackensack, N. J., illustrates and describes in detail the latest in portable wheeled pots for the melting and heating of sewer pipe and electrical pipe compounds, such as Sewerseal, G-K, Hydro-tite, Mineral Lead, Enamels, tar, etc. Units come equipped with either kerosene burner outfits or bottled gas burners.

Dredging Ladders for Sand and Gravel

A 16-page booklet (Catalog 83) on the "Swinteks" dredging ladders is available from Eagle Iron Works, 216 Holcomb Ave., Des Moines 13, Ia. Sketches show how the traveling chain on the "Swintek" ladder continuously passes over the suction nozzle on the dredge, thus acting as a screen to keep boulders from getting in and clogging up the suction line. They show how cutter bars on the traveling chain agitate the deposit to increase intake of solids and how these cutter bars hog through clay strata to get at the sand and gravel in rivers and ponds. Dozens of on-the-job pictures show many types of suction dredges equipped with an Eagle "Swintek" ladder.

Heavy Equipment Catalog

A new heavy equipment catalog (Form 1262), available from Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore., features Caterpillar-Hyster "packaged" equipment for more efficient utilization of machinery on specific jobs. The catalog illustrates the use of logging, loading and road building equipment with actual on-the-scene operations in different parts of the world. Equipment includes logging arches, winches, yarders, donkeys, earthmoving, loading and road building machinery. The catalog emphasizes the need for selecting the right combination of tools to do a specific job.

Push Loading of Scrapers

The New D8 Pusher is the title of a broadside (Form 30903) published by Caterpillar Tractor Co., Peoria 8, Ill. Complete with illustrations, including a detailed cut-away drawing of the new oil-type clutch, the broadside describes application of the D8 to push-load in tandem by using a C-frame and push block. Speed and economy in getting scrapers loaded are stressed in reporting on the versatility of the Cat D8 crawler tractor. A detailed specification sheet completes the broadside.

Hydraulic Truck Gate

A new bulletin (BH-53105) on the improved Heiloader is available from The Heil Co., Milwaukee 1, Wis. The 4-page bulletin pictures the Heiloader in various stages of operation. A large, detailed photograph illustrates the exclusive manufacturing and safety features of the new, improved Heil hydraulic tailgate. The same illustration utilizes a two-color treatment showing in detail how the tailgate looks on a truck. Complete specifications for all types of installations are clearly given.

Hough "Payloaders"

A new 16-page catalog (Form 255) on the Hough Model HR 4-wheel drive "Payloader" tractor shovel, available from the Frank G. Hough Co., 768 Seventh St., Libertyville, Ill., contains action views of this 1 cu. yd. machine doing earth and material handling jobs for cities, counties, states, contractors, aggregate producers and industrial plants. Exclusive and important details are fully highlighted. Included also are pictures and detailed specifications of all seven sizes of "Payloaders."

Diesel Engine Applications

Applications for Caterpillar diesel engines are covered by photographs and text in "The Power Parade," a booklet (Form 30757) released by Caterpillar Tractor Co., Peoria 8, Ill. The 8-page booklet carefully balances material on the many uses of Caterpillar engines with the vital data concerning research, engineering and manufacture. In all, 28 different applications are depicted. Particularly noted are construction jobs, sawmills and oil drill rigs.

Technical Bulletin on Low Hydrogen Electrodes

A new 8-page technical bulletin (AR 53-18), entitled "The Facts About Low Hydrogen Electrodes," published by Alloy Rods Co., York, Pa., deals with recent technical developments in the low hydrogen electrode field, with chapters devoted to history of this type of electrode, effects of hydrogen, effects of the basic slag, control of hydrogen, welding procedures, and applications.

Municipal and Industrial Waste Pumps

A new 12-page bulletin on municipal and industrial waste pumps has been released by Marlow Pumps, Dept. RS, Ridgewood, N. J. The new booklet covers features, performance information, specifications and selection data for plunger sludge pumps, mud-hog diaphragm pumps, and self-priming centrifugal pumps used on sludges and slurries.

Contractors' Road Material Scale

The Contractors' "Special"' road material scale is illustrated and described in a circular issued by Winslow Government Standard Scale Works, Inc., Terre Haute, Ind. This scale is built to meet the needs of road contractors for a truck scale with portability. It is made in 15, 18, 20 and 30 ton capacities, and can be readily set up and placed in use within a few hours. It is suitable for weighing road material at job set ups, stock piles and crushing plants when the use of a scale is needed for only a few hours or several days.

Four Wheel Drive Shoveloader

Advantages of using a 3 to 1 planetary type gear reduction in each wheel of the new Baker-Lull 4-wheel drive shoveloader are explained in an 8-page, 4-color brochure prepared by The Baker-Lull Corporation, 314 West 90th St., Minneapolis, Minn. Brochure also gives complete specification data on this new 1½-cu. yd. unit such as loading capabilities and detailed tractor information. Other advantages of this "self-contained" Shoveloader such as visibility, operator safety, rough terrain operation features, four-wheel power steering are also explained.

Buyers Guide for Testing Instruments

A buyer's guide on electric testing instruments is available from the General Electric Co., Schenectady 5, N. Y. The new 16-page bulletin, designated GEA-5469B, provides data on such instruments as hook-on volt-ammeters, hook-on watt-meters, hook-on power-factor meters, portable recorders, voltmeters and ammeters, phase-sequence indicators, hand pyrometers, surface roughness scales, insulation-resistance meters, and others. Application data, features of each instrument, and prices are included.

"Shovels at Work"

Versatility of a new product is emphasized in "Shovels at Work," (Form 30791) a publication of Caterpillar Tractor Co., Peoria 8, Ill. Caterpillar's new No. 6 shovel with the earlier released HT4 shovel are pictured in a variety of earthmoving operations. That these units are not merely tractors with hydraulic shovels attached, is brought out. They are, says the booklet, engineered and built as an integral unit—a scientifically balanced machine. According to the publication, the welded box-section frame of the shovel unit prevents bucket twisting and excessive hinge pin wear.

Job Data on Truck Crane

A "picture-book" of on-the-job views of 6-ton Lorain TL-10 truck crane installations is now available from The Thew Shovel Co., Lorain, O. The title is "The Thew-Lorain TL-10 Truck Crane at Work." The Lorain TL-10 truck crane is the newest addition to the Lorain line. It retains all the turntable features of the Lorain "TL" series such as "packaged" components, anti-friction bearings, fast, sensitive clutch action, etc., but weighs less and has been otherwise modified to enable it to be used on commercial truck chassis. Full page size pictures, job data, and information on the kind of new or used trucks used in each instance for mounting the TL-10's are included. A variety of front end equipment is shown.

Bituminous Paver for Smaller Jobs

The new Adnun, Jr., Model 8 bituminous paver is illustrated and described in a folder issued by the Foote Construction Equipment Division of Blaw-Knox Co., Nunda, N. Y. Important features are pictured and described and specifications are given. This new paver is built to the same pattern of rugged construction and principles of quality found in the larger Adnun black top pavers. In operation the Adnun Junior Model 8 is towed by the truck as the truck dumps to the Adnun hopper. A 12 hp engine supplies power for maneuvering backward or forward and for traveling empty to new locations on the job. An easily removed, heavy-duty, rigid hitch makes possible lifting the Adnun with the truck dump body hoist and the machine can be towed to distant locations by the truck, elimlinating all need for a trailer.

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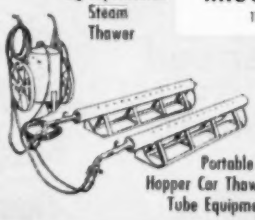
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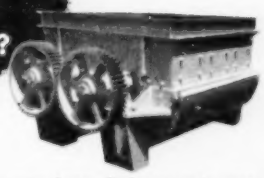

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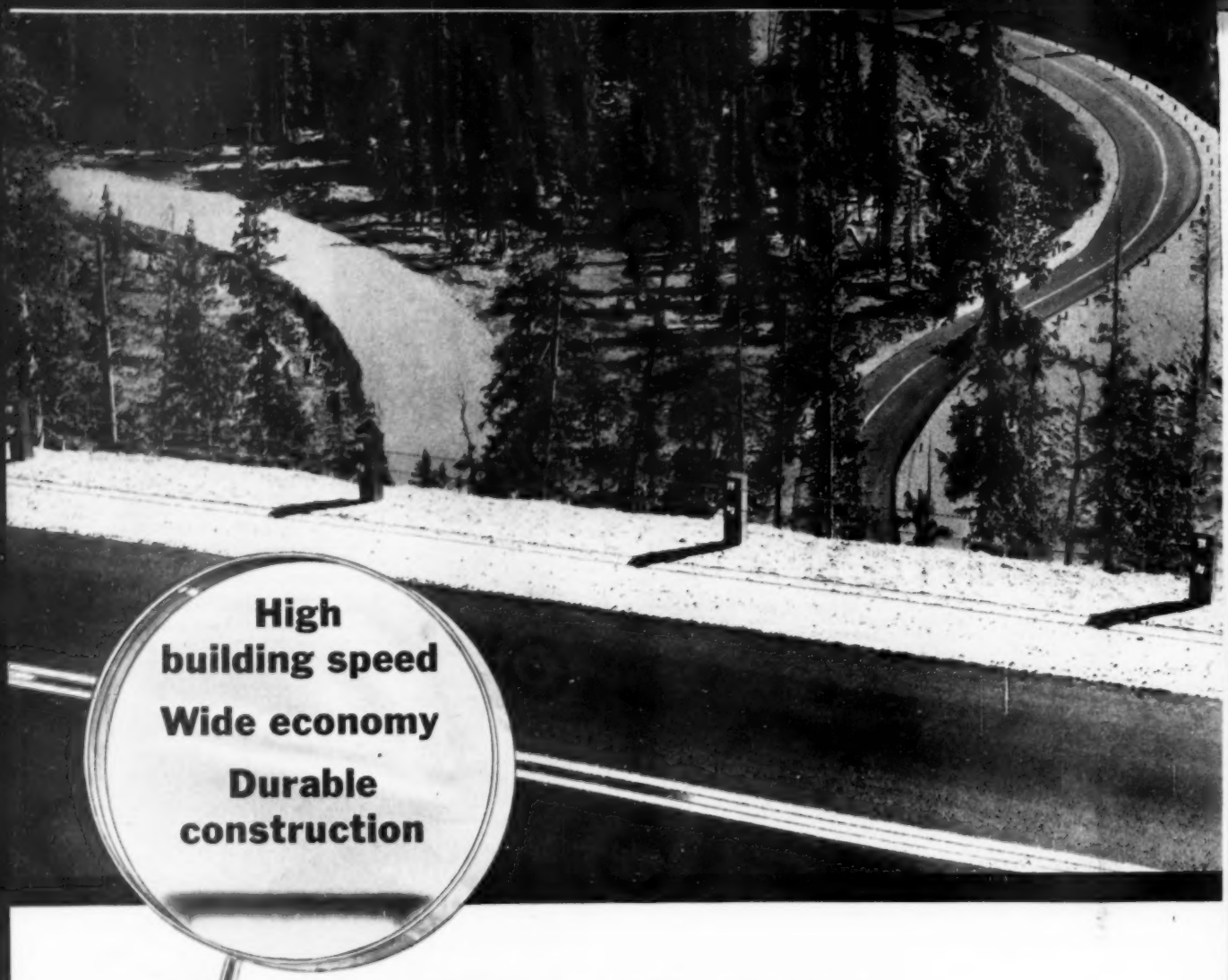

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Northern Manufacturer of Road Building Machinery wants a Road Construction Engineer desirous to enter Sales field. One acquainted with road building machinery to act as representative in the South, supervising Distributors activities of the Manufacturer, calling with distributor or salesmen on officials of states, municipalities and private clientele in the Southern states. He would have to work from his home as his headquarters. Salary, commission and travel expenses provided for.

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DRAGLINE BUCKET, Bucyrus Standard Red Arch, 2½ CY, Model AY, Ser. #135.

HAND PLANER & JOINTER, Oliver, 16", Model 166-CD, Ser. #67086, 5-HP Electric Motor.

CONCRETE BUCKET, Johnson-Fitzgerald, 1 CY, Manual, Ser. #32732-H.

DROP BALL, Cape Ann, 6,500#, Forged Steel.

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5 Etnyre Road Oil Distributors. 1300 gallon capacity, insulated tanks, full circulating air-controlled spray bars, high pressure burners, 5th wheel Tachometer. Mounted on Model 146 W 2½ ton Brockway Trucks. 1000-20 tires. Condition very good.

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Caterpillar D-13000 w/V-belt drive.
Allis-Chalmers model L-90, 110-hp.
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Page 3-yd. RC Dragline Bucket.
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6—Gardner Denver Air Hammers
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Cat. 12 Grader
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Lorain L-50 Crane, Dragline #20440
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1—LeTourneau Model E-18 Carryall.

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Scraper with front dolly (can be used with C Roadster or C Tournamatic Tournapull).

All above equipment in *excellent condition.*

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Cletrac BG & 1 yd. Ware Loader....1949	Good	3,350
Cat. D-2 with hyd. Bulldozer.....1939	Good	2,000
Cletrac BG with hyd. Bulldozer.....1950	Good	3,000
Int. T-14 with hyd. Bulldozer.....1946	Fair	4,500
Loraine 75A 1¼ yd. crawler Shovel-Crane, Clam, Drag, also 1-yd. buckets.....1929	Operating	4,000

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Compressors, Skid Mounted, $1000.00 For Lot.

Both Terrific Bargains.

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Two Bucyrus Erie B170 Scrapers. Each 5,500
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FAMOUS MODEL L ON RUBBER

1936 model, clean and in perfect condition for belt or drawbar work. $850 FOB Easton, Maryland.

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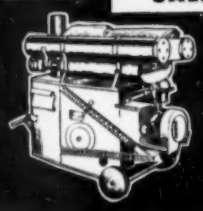

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1—1948, 4½ Ransome mixer, mounted on a 1948 Ford F-8, Thornton Tandem. 10/20 tires, mixer, truck and tires are in excellent condition.

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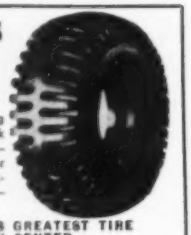

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The sale will be held on Pine Crest Drive, West about 1 Mile South of the Court House Highway 43 Cut-Off, Marshall, Texas.

Partial List:

Model 25 Northwest Dragline, Model TL-20 Loraine Motor Crane, ¾ Yd. Bucket, 1 D-8 Cat. Cable Unit Bull Dozier Model 85, 2 D-8 Cats. LeTourneau Cable Unit and Dozier, 1 D-7 Cat. LeTourneau Cable Unit and Model 7F Dozier, 2 D-7 Cats. Cable Unit Dozier Model 75, 1 D-6 Cat., 1 D-4 Cat. LaPlante Choate Dozier, 1 International TD-14, 2 International TD-24 with Power Unit and Dozier, 2 Farmalls with Pneumatic Rollers, 3 Model 12 Cat. Motor Graders, 2 Cats. DW-10 LaPlante Choate Scrapers, 1 DW-10 Cable Unit Model 21 LeTourneau Scraper Model LS, 1 DW-10 Cat. Cable Unit Model 21 Scraper Model 10, 2 DW-10 Cats. LeTourneau Scraper, 4 Euclid Bottom Dump Wagon Tractors 20 Cu. Yds., 3 LeTourneau Scrapers, 2 LP's one LS, 1 LaPlante Scraper, C108, 8 Sheep Foot Rollers, 10 Ton Tampco Roller, 2 Transit Mix Trucks 3 Cu. Yds., 4 Ford Dump Trucks, 52 Chevrolet Carry-All like new, 2 Chevrolet Pick-Ups, 2 Large Concrete Mixers, Portable Electric Welders, 1 Bin-A-Batch 2 Compartment Portable mounted on Rubber, Concrete Buggies, Shonrock Cable Dump 12½ Yd., Builder's Hardware, Building Materials of all kinds, Steel and Wooden Forms, DeWalt Saws, Delta Joiners, Jack Hammers, and many other items too numerous to mention. Inspection any time prior to sale. *For further information and brochure contact*

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This sequence of pictures shows how Tippecanoe County, Indiana, replaced an old failing bridge with a culvert of sufficient size to meet waterway requirements. The scene is a County farm road, northwest of Lafayette, Indiana. The installation consists of multi-plate corrugated pipe arch (Armco) with ends beveled to fit the fill slope. Arch is of 5 gage metal 16'6" x 10'1".

The pictures pretty well summarize the methods, which resulted in a safe and economical structure for modern traffic. G. O. Keilholz, County Road Supervisor.

4 The pipe-arch in place. Abutment now ready for the finishing touches

5 The new bridge completed except for grading, paving, and part of the end-finishing

WITH THE MANUFACTURERS & DISTRIBUTORS

B-G Appoints New Area Sales Manager. Edwin J. Curtin, heretofore in the field engineer section of Barber-Greene Co., Aurora, Ill., has been appointed sales manager of the company's Northeastern sales area, with headquarters in Boston, Mass. He succeeds Earle F. Lamprey, who has been assigned to a new post in the company's New York office. Mr. Lamprey will supervise export activities in the New York area and will also be charged with government liaison on export matters and will assist the many New York manufacturers and engineering firms who are served by Barber-Greene.

New Lippmann Distributors. Lippmann Engineering Works, Milwaukee, Wis., has appointed the following new distributors: Casey-Metcalfe Machinery Co., 5107 Telegraph Road, Los Angeles, Calif., for the lower half of California; Vancouver Equipment Corp., Ltd., 285 East 1st Ave., Vancouver, B. C., for British Columbia; Highway Equipment Co., 840 S. 19th St., Harrisburg, Pa., for Pennsylvania.

New Euclid Distributor. Colorado Builders Supply Co., 1300 West Evans Ave., Denver, Colo., has been appointed distributor for Euclid Road Machinery Co., Cleveland, O., for Colorado, most of Wyoming and 11 western counties of Nebraska.

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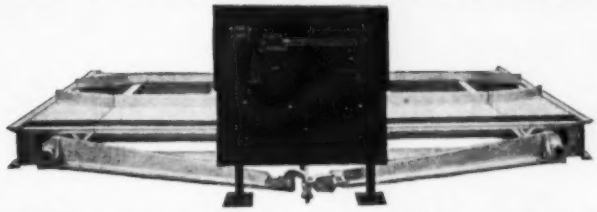
"THE CONTRACTORS' SPECIAL SCALE"



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Write us for name of your nearest distributor.

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Blaw-Knox Promotions. P. C. Haldeman, heretofore general superintendent of the Rolls Division of Blaw-Knox Co., Pittsburgh, Pa., has been promoted to works manager of the Foote Construction Equipment Division, Nunda, N. Y. H. C. Stirling succeeds Mr. Haldeman as general superintendent of the Rolls Division.

PCA Appoints New District Engineer. Donald H. Herak has been appointed District Engineer of the Spokane, Wash., office of the Portland Cement Association. He succeeds Robert E. Tobin, who has accepted a position as engineering consultant for the Spokane Concrete Pipe Co. Mr. Herak joined P.C.A. in August, 1951.

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It is 50% lighter — smoother acting — easier to service and mount.
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1. Cam actuated teeth extend to grip inside of standard rope pulley cup.

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3. Rope pulley available for hand starting in case of emergency.

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If you make, sell or use products like these, you can reduce weight — improve starting — increase starter life. Chain Saws • Pumps • Power Mowers • Outboard Motors

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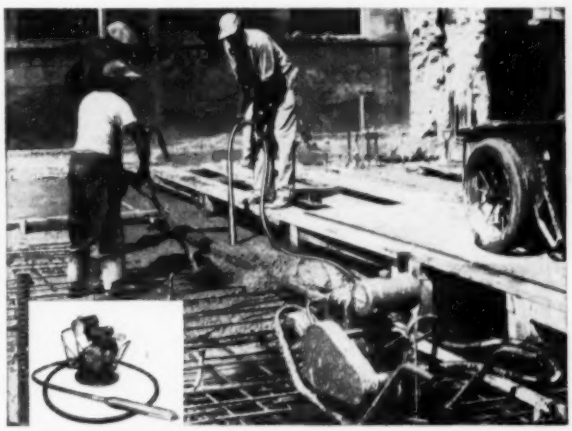

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You'll get *BEST results* with the "*Scotchman's*" unique, *air-blown*, "*bird-shot*" *melting pattern*—

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2011

Natural Rubber Bureau Expands Staff. The Natural Rubber Bureau, Washington, D. C., has expanded its bureau field staff. The country has been divided into three main sections and a traveling technical engineer to provide consulting services has been assigned to each. The east will be covered by Earl H. Brengle, with headquarters in Boston, Mass. The middle states will be covered by Ralph E. Davis, with headquarters in St. Louis, Mo. The west, temporarily, will be covered by William J. Ryan, assistant to Harry K. Fisher, engineering consultant to the Bureau.

Caterpillar Appoints Supervising Engineers. Two new supervising engineers have been appointed by Caterpillar Tractor Co., Peoria, Ill. Donald E De Canniere will supervise engineering work with bulldozers and cable controls, and John A. Junck assumes supervision over work on hydraulic controls and tool bars. These two sections plus the section which includes scrapers, wagons, and ripper design, under the supervision of Woody Kimsey, will all come under the direction of Carl Kepner, recently appointed assistant chief engineer.

Marion Announces New Distributors. Marion Power Shovel Co., Marion, O., has appointed the following new distributors: Neff-Thomas Machinery Co., 1920 N. W. Miami Court, Miami, Fla., for southern half of Florida; Tulsa Equipment Co., Inc., 1804 North Lewis, Tulsa, Okla., for the state of Oklahoma.

Nordberg Opens New District Office. Nordberg Manufacturing Co., Milwaukee, Wis., has established a new district office at 3300 South Second St., St. Louis, Mo. This new south central district office will be in charge of Harold M. Propp, formerly central district manager.

Link-Belt Speeder Promotes Rowand. Gordon W. Rowand, heretofore district representative in Illinois, Michigan and Indiana, has been appointed assistant sales manager of Link-Belt Speeder Corporation, Cedar Rapids, Ia.

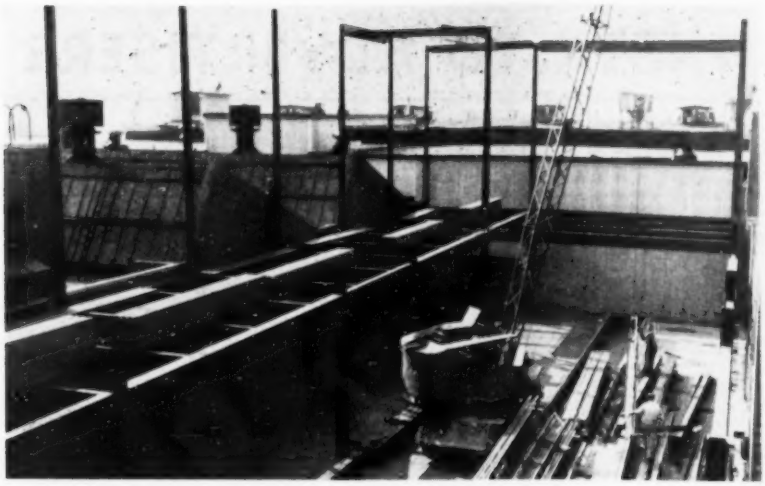
Koehring Personnel Changes. The Construction Machinery Division of Chain Belt Company, Milwaukee, Wis., has announced the following personnel changes in their sales organization. Robert G. Kuhnmuench has bee nappointed Western District Manager with his office at 3838 Santa Fe Avenue, Los Angeles, Calif. He has been eastern district manager since March of 1952. Replacing Kuhnmuench as eastern district manager will be Richard Seaman, who heretofore has been assistant to the sales manager.

Roebling Engineer Supervises Urban Prestressed Concrete Bridge. H. Kent Preston, Bridge Engineer, recently returned from Cuba where he supervised the placing and tensioning of first strands on Agabama prestressed concrete bridge under construction for Cuba.

Agabama is one of four structures for which Roebling is supplying strand, fittings, and technical assistance. The prestressed section of the bridge is approximately 180 feet of the overall length of two miles.

Hough Names New Representatives. The Frank G. Hough Co., Libertyville, Ill., has appointed two new district representatives. Jack C. Bever will operate in the sales district comprising the District of Columbia, Maryland, Virginia, West Virginia and the Carolinas. Dwain Richey will travel in Arkansas, Louisiana, Oklahoma, Texas and New Mexico.

Carr Appointed Manager of Pump Sales. John S. Carr has been appointed manager of pump sales for American Manganese Steel Division of American Brake Shoe Co. Formerly a sales engineer, he has been with the company since 1949. He will be located at the Amsco plant in Chicago Heights, Ill.



Cummins Adds to Plant. Steel erection for a building to house a new 300 foot, completely air-conditioned, high-speed assembly line is now in progress at Cummins Engine Company, Inc., Columbus, Indiana. This 3-story plant expansion, part of a $7,000,000 program now under way at Cummins, is designed to increase production and plant efficiency.

H. N. Nelson Is Dead. H. N. "Scoop" Nelson, assistant sales manager, Findlay division, Gar Wood Industries, was killed Sept. 29 in an automobile accident in Moorhead, Minn. He was 43 years old. Well known as "Scoop" throughout the construction industry, Mr. Nelson spent more than 20 years in the sales and service of heavy equipment. As Gar Wood's top field expert on tractor equipment and scrapers, he was a familiar sight on jobs throughout the country.

New Joy Distributor. Olson Equipment Co., 2930 Blaisdell Ave., Minneapolis, Minn., has been appointed distributor by Joy Manufacturing Co., Pittsburgh, Pa., for the state of Minnesota for Joy construction equipment.

Hoosier Appointed Marmon Herrington District Manager for Southeast. Denzil Coffey of Fillmore, Indiana has been appointed District Manager for the Southeastern portion of the United States by the Marmon-Herrington Company, Inc. of Indianapolis, manufacturers of all-wheel-drive trucks, trolley coaches and motor coaches. To his new assignment, Mr. Coffey brings three years of experience in the Marmon-Herrington Sales Department. He was formerly employed by the American Zinc Products Company of Greencastle, Indiana. He is a graduate of Depauw University and was with the Navy Amphibious Forces in the Pacific during World War II as a Diesel Engineer.

Marlow Appoints New Sales Engineer. William Maxwell has been appointed sales engineer for the new England territory of Marlow Pumps, Ridgewood, N. J., with headquarters in Natick, Mass. He succeeds William Van Blarcom who was made general manager of Marlow's De Queen, Ark., plant.

Catalane Appointed Sales Manager. J. F. Catalane has been appointed sales manager of the small excavator division of Harnischfeger Corporation, Milwaukee, Wis. He succeeds F. C. Edwards, recently appointed general manager of P & H division, located at Crystal Lake, Ill.

Smith Appointed Koehring Vice President. E. A. Smith has been appointed vice president of the Koehring Co., Milwaukee, Wis., and manager of its two export sales subsidiaries, Koehring Inter-American Co. and Koehring Overseas Co. His headquarters will be in Milwaukee. He replaces R. E. Stewart who resigned recently. Until his recent appointment Mr. Smith was a sales engineer for C. S. Johnson Co., Champaign, Ill., a Koehring subsidiary.

U. S. Rubber Company Announcements. Five major organizational changes in the sales department of U. S. tires division of United States Rubber Co. have just been announced by H. C. Oliver, sales manager. H. Newman Roberts, formerly district manager at Charlotte, N. C., has been promoted to southern division manager with headquarters in Atlanta. He will also supervise the Atlanta, Charlotte, Dallas, Memphis, New Orleans and San Antonio districts. Walter F. Brown is the new manager of the revised north central division, with headquarters at Detroit. He will also be in charge of the Detroit, Buffalo, Cleveland, Grand Rapids, Indianapolis and Pittsburgh districts. He was promoted from manager of market development at the New York general offices. Harry R. Mack moves from southern division manager to central division manager with offices in Chicago, where he will also supervise the Chicago, Fargo, N. D., Milwaukee, Minneapolis, and St. Louis districts. New district managers just announced are: Edwin W. Means, Charlotte, N. C., and Robert R. Walker, Philadelphia.

Otterness Appointed District Manager. R. A. (Bob) Otterness has been appointed Northwestern district manager for Schield Bantam Co., Waverly, Ia., with headquarters in Spokane, Wash.

Do your sealcoating and ice control jobs the fast easy Swenson way. Spreads salt, chloride, sand, rock chips, gravel or cinders any width or amount desired.

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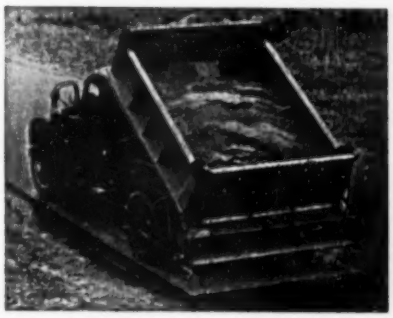
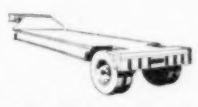
Swenson Spreader & Mfg. Co.
Lindenwood, Illinois



MODEL PS—Single axle, spring mounted platform or float.



MODEL KS-F—Single axle flat bed semi.

YOU'LL SAVE TIME AND EQUIPMENT . . . with A TRANSPORT TRAILER

MODEL GXTT 14 thru 22-ton capacities . . . Gooseneck type tilting platform cargo carrier equipped with two double-acting hydraulic cylinders cushion trailer platform when tilted, with or without load. Saves time—saves equipment—one man operation. Exclusive TRANSPORT tandem axle assembly gives both lengthwise and crosswise oscillation.

FOR ADDED SERVICE . . . Single or dual axle TRANSPORT front dollies convert semis to full trailers easily and quickly.

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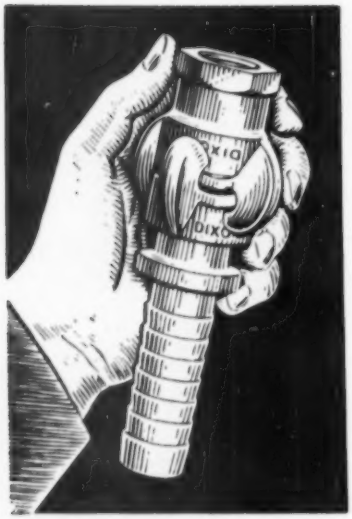
TRANSPORTATION ENGINEERING A SPECIALTY
CEDAR RAPIDS, IOWA, U.S.A.



THIS *Versatile Coupling*

while used primarily for air-operated tools in field and factory, is equally efficient for water, oil and spray service. Illustration shows hose end and female I.P.T. end connected.

"AIR KING"
QUICK ACTING UNIVERSAL HOSE COUPLING

Heads are locked by pressing together and giving quarter-turn. These locking heads are identical for all sizes of hose or threaded ends, permitting the coupling of any two sizes of hose, or hose and pipe, within the "AIR KING" size range. Equipped with patented safety locking device. Bronze or rustproofed malleable iron, in sizes up to 1".

Two Hose Ends Connected — Male I.P.T.End

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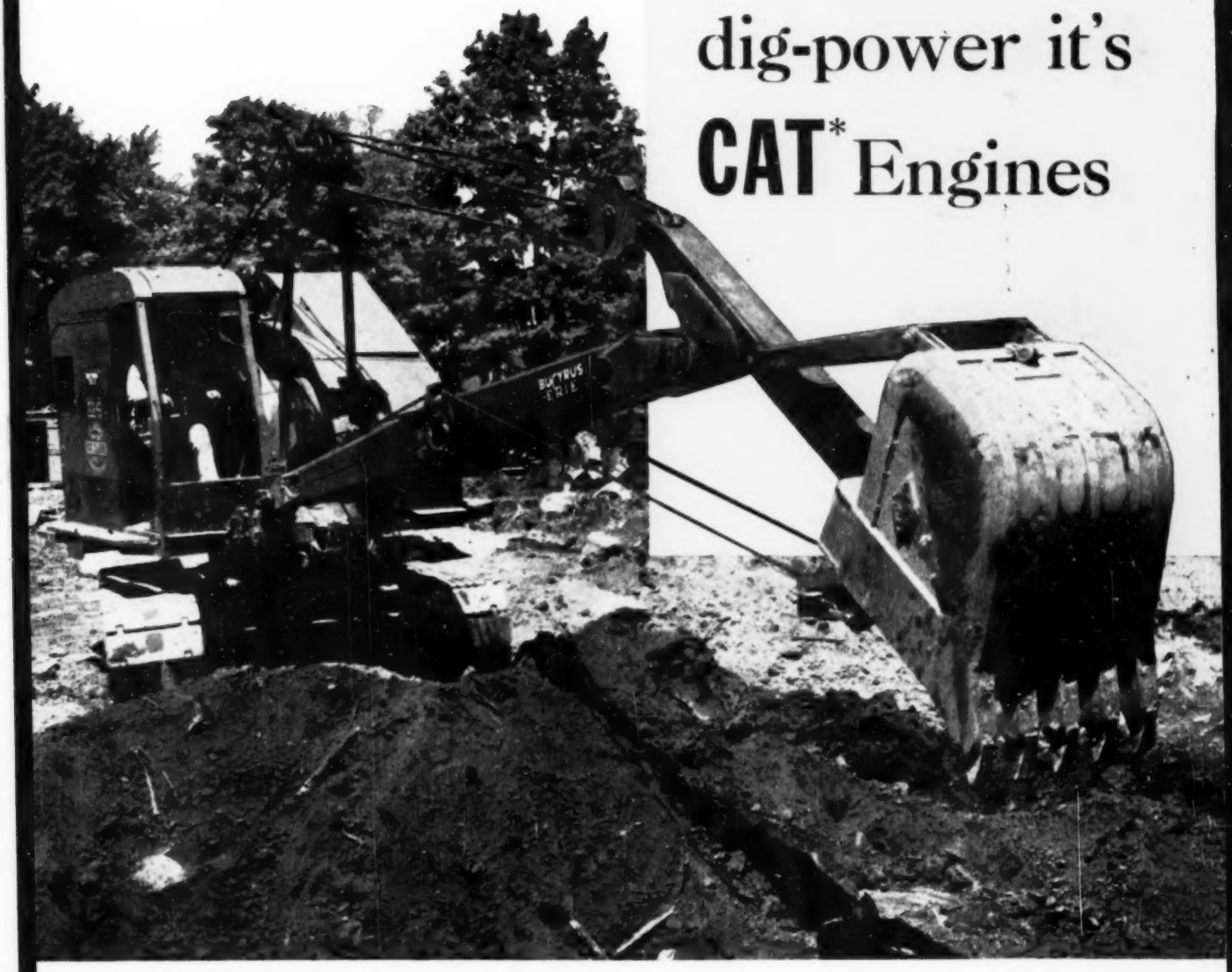
For dig-power it's CAT* Engines



When there's Caterpillar power behind the bucket you can look for real production. The shovel or backhoe will be working – not standing idle while somebody tinkers with the engine.

This Caterpillar-powered Bucyrus-Erie 22-B is one of a pair owned by Calandro Construction Co., Scarsdale, N. Y. It's working on a 14,000-yard excavating job for foundations of the new Mamaroneck High School. Whether it's trenching with a 1-yard backhoe or loading trucks with a 3¼-yard dipper, the Caterpillar D318 Engine puts out plenty of digging power.

John Calandro, Jr., says: "Both of our Caterpillar-powered shovels as well as our D8 Tractor have given very satisfactory service over the many hours they have been operated."

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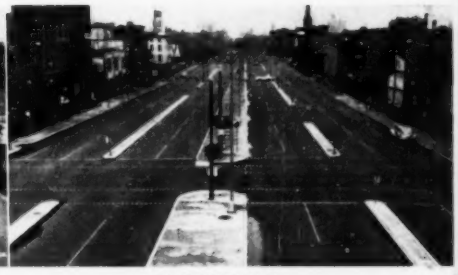

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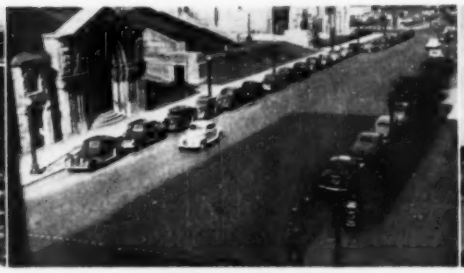

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